TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

WITH

AN ABSTRACT OF THE PROCEEDINGS AT BOARD AND GENERAL MEETINGS, AND THE PREMIUMS OFFERED BY THE SOCIETY IN 1902

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TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

OVERDRESSING OF BARLEY.

By Hugh Baird, Glasgow.

It will be within the recollection of the members of the Highland and Agricultural Society that, through the interest and courtesy of their Directors, an opportunity was afforded maltsters and threshing-machine makers to confer together regarding the evil effects resulting from the overdressing of barley. The opportunity of discussing the question was largely taken advantage of by those interested, the meeting taking place in the showyard at Inverness in July last, and a report of the proceedings was published at the time in the 'North British Agriculturist.' No doubt the circulation of that report, and the subsequent circular which was issued to the farmers throughout the country by the three leading firms of Scottish maltsters and the Edinburgh Brewers' Association, would be productive of some good in bringing about an improvement in the manipulation of the threshing-machine.

It affords me pleasure, however, to accept the invitation of the Secretary of the Highland and Agricultural Society to contribute this paper on the subject of "Overdressing of Barley," and to supplement the views which were expressed at that meeting in Inverness. I do so all the more willingly in the hope that our farmer friends throughout the length and breadth of the land

may herein find sufficient to justify them in taking the matter earnestly in hand.

Time and again has this matter been brought under the notice of farmers, more particularly in England, where precisely the same complaints have for many years been made as to the damage done to the grain from a maltster's and brewer's point of view. Yet these repeated remonstrances have in large measure been in vain. Indeed farmers in many cases seem to resent what is sometimes described as an interference with their business, apparently overlooking the consideration that it is only right and natural that the brewers and maltsters, as large consumers, should seek for the precise article that best suits their business.

In these days, when science plays such an important part in the principal breweries throughout the country, and when brewers have become so particular regarding the quality and condition of the malt which they buy, it has become absolutely necessary that the maltster in turn should look to the farmer to give him a barley that had been well and carefully threshed. It is the maltster who really first experiences in practice the bad effects of carelessly dressed barley. When a parcel containing broken, bruised, or skinned grains finds its way to his malting-floor it very soon shows signs of mould. Mould means unsoundness in the malt, and, as a natural consequence, bad results in the brewery; and although only a small particle may at first be observable, it very soon spreads itself throughout the whole floor. I think it will be admitted, therefore, that after an experience of this kind the maltster has every right to warn the farmer regarding the danger he incurs in not giving proper attention to this most important question of threshing. Of course the farmer is not compelled to accept the advice which is tendered, but if he spoils his market by neglecting it he cannot blame any one but himself. Moreover, it is perhaps as well that he should be reminded that the unsatisfactory condition of our home-grown barleys after threshing have in recent years compelled brewers to use much more largely of malts made from foreign barleys, which are invariably more perfectly threshed; and there is a great danger of the foreign ultimately becoming the principal part of the grist, largely owing to the defects I have named.

The Mischief and how it arises.

In the days of our fathers, when the flail was in use, close dressing was not possible, and consequently such complaints as are now made regarding the condition of the threshed barley were practically unknown. Since the introduction of the threshing-machine, however, the complaint has been a continuous one,

although it is not to be assumed from this remark that the threshing-machine is wholly blamed for this state of matters. It would be as absurd to make a statement of this kind as to suggest that we should revert to the primitive method referred to. There can be no doubt that the threshing-machine is now as indispensable as the reaping-machine, and those farmers who are fortunate enough to possess one of their own, and who also possess the special drum and concave which has been designed for barley-threshing, need have no difficulty in threshing their barley in an acceptable manner, provided due attention is given to the setting of the machine.

Farmers, however, who are wholly dependent upon the travelling threshing-machine do not always give that attention to the setting of the machine which is necessary, nor have they the same opportunity of threshing only when the barley is in a thoroughly suitable condition. They are often obliged to take the machine when it is in their district; and as it is generally hired by the day, they are naturally anxious to get as much out of the machine each day as is possible. In these circumstances the threshing is frequently rushed without due regard to the result, the setting of the machine being too often left entirely to the discretion of the machineman.

In many cases the threshing-machine is set too closely, with the object of removing the awns as completely as possible and imparting to the grain a short plump appearance. This is frequently done under the mistaken impression that the barley is thereby improved, and that a higher price will be obtained for it. It is manifest, however, that such an idea is wholly erroneous, as the quality of the grain from a maltster's point of view cannot be improved by such a method. As a matter of fact, this close dressing is one of the most serious errors practised by the farmer. No doubt one of the principal reasons for the existence of this practice is that in some districts the objectionable plan has hitherto existed of allowing an extra price for barley weighing over 56 lb. per bushel.

The injury caused by overdressing is not limited to those corns which are cut in half. Indeed corns closely nipped at one or both ends are perhaps even more objectionable. The same remark can also be applied to corns that have been bruised and peeled.

It has been said by some authorities that a corn should not be regarded as cut or damaged so long as it will grow. This, however, is an error, so far as the maltster is concerned; for although a damaged corn may grow perfectly, yet it will mould on the malting-floor. It is also important to state that if by too vigorous threshing the husk of the barley is damaged, although the damage may not be visible, such damaged barley

may also lead to irregularities in the process of being malted, and produce those mould fungi which cause so much trouble in the brewery. With such barleys mould develops much more readily than is the case with barley that has been less severely treated, and for this reason it is impossible too strongly to condemn close dressing.

Care taken in Foreign Countries.

As showing the greater care in threshing exercised by the Continental farmers, it may be well to mention that at the German Barley Exhibition the judges pay particular attention to the point I have alluded to, and any samples which give evidence of having been improperly threshed are punished by heavy counter-marks. It is no longer considered by them to be a fault if a small portion of the awn is left attached to the barley-corn.

Difficulties in treating injured Barley.

While it is possible, of course, for the maltster to remove to a great extent by machinery the broken corns out of a lot of barley, still the presence of such broken corns in a sample naturally leads one to the conclusion that there will also be *chipped and nibbled ones,* and these it is impossible to remove. The same remark can be applied to that very dangerous and deceptive corn, from a buyer's point of view, known as a "cracked corn," which is not so easily discerned at the time of buying, but soon declares itself on the floors and produces much mischief there. Still another corn which may appear perfect at a casual glance is upon closer examination often found to have a chipped "havel" end. This form of chipping it is no doubt difficult to avoid in a tough sample, as the awn will not break easily, and a portion of the skin comes off with it. Even hand-rubbing of such grains will cause the removal of some skin. Of course if this nipping takes place at the germinating end the corn will not start *growing at all,* but will commence to mould and contaminate the otherwise sound grain around it, with the result that if the corn is not kept constantly moving on the floor clots will be formed, necessitating loading on the kiln earlier than is desirable, thereby giving a hard and inferior instead of a tender malt.

Remedial Measures.

While one cannot, perhaps, expect that all these imperfections which have been alluded to can be immediately eliminated through the personal attention of the farmer, still I feel con-

vinced that if he evinces a keen personal interest in the adjustment of the machine, and insists upon the machineman turning out his barley free from the objections described, he will in time succeed in obtaining more satisfactory results, and besides giving the maltster what he wants, will obtain for himself an enhanced price.

Improvement of Threshing-Machines.

With the view of suggesting how some improvement may be obtained, I propose now giving some consideration to the matter of the threshing-machine itself, so far as it concerns the threshing of barley.

It is, I think, generally admitted that the modern machines have reached a high degree of perfection so far as general threshing is concerned; but it must be recognised that, from the peculiar nature of the growth of barley itself, and also from the way in which it is sometimes harvested, there are many difficulties in the way of threshing it without "nibbing" it too closely. The kernels, as is well known, grow on each side of the stalk, and the awns grow on the outside of the ears opposite each other (fig. 1). Taking a grain of barley in the hand, it will be found that if the awn is broken off by pressure on the *outer* side of the ear, it will break off without "nibbing" or skinning; but if the pressure is applied in the opposite direction, the awn will break off and carry a part of the skin with it. As the crop in passing through the drum of the machine receives the blows of the beater, the kernels will be struck in various directions, some from one side, some from the other, and, of course, many others flatwise, the consequence being as I have mentioned, that in some cases the awn will be broken off, as it should be, without damage, and in

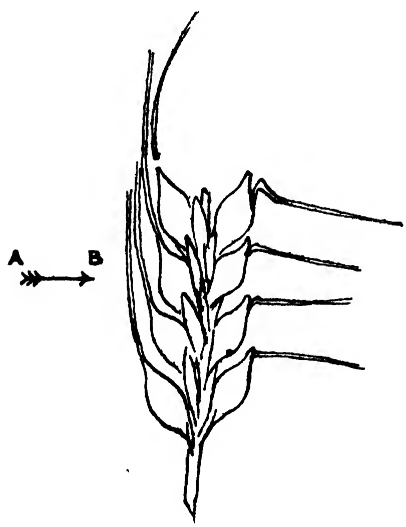

Fig. 1.—*Portion of Head of Barley.*[1]

[1] The drum is supposed to strike the ear in the direction A B. The awns on the left will be broken off without "nibbing." These on the right will break off, carrying a part of the outer skin with them.

others the kernel may be "nibbed" or skinned. In some states or conditions of the crop it is almost impossible to get the grain out of the ear, and the awn removed, even with the most careful setting, without some damage being done to the corn. It is apparent, therefore, that it is better *not* to attempt to awn the barley too closely, but rather to leave a little of the awn on than to risk "nibbing" it.

Importance of careful Adjustment of Threshing-Machines.

Apart, however, from this one feature of the threshing operation, there is no doubt that a great deal more damage is done than there is any occasion for, owing to the threshing not being carefully performed, and the different parts of the threshing-machine not being properly adjusted. It is, of course, quite obvious that if, in order to get all the grain out of the ear, and especially when the barley is difficult to thresh, the drum and concave are set *too* close, there is more danger of breaking and "nibbing" than when these are not so closely set.

A new machine will of course break it more than after it has been used for a time and the roughness of the beaters has been

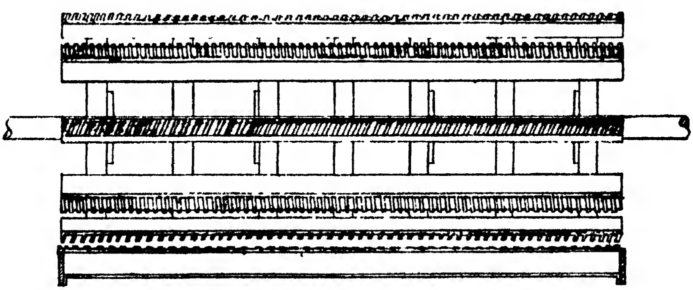

Fig. 2.—*Drum and Concave of Threshing-machine.*

worn off. On the other hand, when a machine has been much worn, the centre of the drum and concave having had the most work, in consequence of the feeding being necessarily more in the centre than at the ends of the drum, the space or distance between them is greater in the centre than at the two ends, and if they are set to thresh clean in the centre they will be too close at each end, and consequently breaking will occur (fig. 2). This fault of course can only be remedied in putting on new drum-beaters and concave ribs. It is calculated that a drum of 22 inches diameter, and running, say, 1100 revolutions a minute, has a periphery speed of, say, 6600 feet a minute, so that any careless setting of the drum will cause undue breakage of the barley.

Great attention should also be paid to regularity of feeding. The engine should be driven at an even speed, and proper care should be taken over the adjustment of several parts of the machine. Moreover, in order to obtain a good sample of barley an undue quantity should not be passed through the machine in one day.

It is not only in the drum of a threshing-machine that unnecessary damage to the kernel takes place through imperfect setting of the several parts, but also in the barley-awner, through which the grain subsequently passes. Here, if the beaters are set too close and the barley is roughly handled (every different sample requiring different treatment), "nibbing" will take place.

Those in charge of the threshing should make a point of constantly examining the sample, and if injured in any way, ascertain in what part of the machine it occurs and alter the setting till it is remedied.

The same machine has often to operate on various kinds of grain, but that should form no excuse for bad setting. It is only a matter of taking a little trouble and giving personal attention to this important subject, for by observing the threshing from time to time, the machine can be adjusted so as to do its work in an efficient and satisfactory manner. I understand that at least one eminent firm of threshing-machine makers do make a special drum and concave for barley-threshing which minimises the damage to the grain, and it might be well for farmers to insist upon some sort of special drum being put into the machine when barley has to be threshed, unless there is a special barley threshing-machine in their district.

Another Word to Farmers.

I trust that the effort to bring home to our farmer friends on this side of the Border, that their continued indifference in the matter of barley-threshing must inevitably affect them much more seriously in the long-run than it will the brewers and maltsters, may be productive of some good, and that a distinct improvement in the threshed barley may be the result. I cannot too strongly impress upon them the danger they run of having their barleys supplanted by those of foreign growth, and I feel satisfied that once they take the matter up with vigour half the difficulty will be overcome. Doubtless there will be some fault found in some cases with the threshing-machine itself, but I am convinced that the makers are fully alive to the importance of this question, and have done, and will do, all in their power to produce machines capable of doing their work properly. It was suggested at Inverness that a premium might be offered for the machine best adapted for barley-threshing. Whether the Highland and Agricultural Society will offer such a premium or not

I do not know, but even if they do not, the machine-makers will not lessen their efforts to produce the best.

I may mention that there appears to be not the slightest doubt that considerable improvement in the threshing of barley has already taken place this season, and it is sincerely to be hoped for the sake of all concerned that it may be still further improved.

THE DISABILITIES ATTACHING TO THE PLANTING OF WOODS.

By George Cadell, late of the Indian Forest Department.

It is not, at the first blush, a very fitting task for any one so thoroughly convinced of the value and usefulness of Forestry as the writer to suggest, and even to emphasise, the disabilities which attach to its prosecution in Great Britain; and it could not be a grateful one were it not for the reflection that it is possible that the enumeration of these disabilities may happily lead to their fuller consideration, and possibly to their removal. For they are not imposed either by necessity or by nature, and they are thus within the scope of remediary action. In any case, difficulties and disabilities should be looked fairly in the face, and when they attach to such a costly and permanent improvement as Forestry, no one who fails to recognise their existence can properly take the responsibility of recommending the enterprise.

The Cost of Planting.

The first and most obvious of these disabilities is the cost—the cost including not only the capital outlay, but the burden of interest and compound interest which yearly accumulates upon temporarily locked up and unrecuperative capital. Trees do not, like cereals, yield a return within a year of their being planted. A generation at least must elapse before they can be rightly expected even to begin to pay a money value—although of course the indirect effects in sheltering, draining, fertilising grounds, &c., to which I have always attached far greater importance than to the more direct and tangible ones of pecuniary returns, begin much earlier. In counting this cost, the compound interest on the initial value for the whole period of rotation on which the plantation is worked has to be taken into consideration.

And this is the first question which an intending planter of woods must ask himself, "How much per acre can I afford

to spend on planting with any reasonable chance of the financial success of the undertaking?" The answer to this question, which depends upon factors varying in different districts, will determine another question—viz., "How many acres am I prepared to plant?" For obviously the initial outlay on a small plantation is per acre very much greater than that upon a large one. Leaving actual figures, that great bone of contention by which almost anything can either be proved or disproved, out of the present question, the cost of fencing a large area is very much less proportionately than the cost of fencing a small one: in some districts it is advisable to make holes for the reception of trees—in others cross-slits will answer all the purpose; and so with drains, the cost of trees, whether reared in home nurseries or purchased, and other matters.

The initial question then is this, X acres to be planted at a cost of *x* pounds?

Taxation.

In all such calculations the cost of rates and taxes in the particular district has unfortunately to be taken into consideration. I say unfortunately, for I find myself absolutely at variance with the principle of levying these at all upon planting or any similar enterprise which may be expected eventually to bring prosperity, proportionate to its success, to the district in which it is situated. Our neighbours in France do not exact taxes from private planters of woods for thirty years, dating from the inception of their enterprise; and the same far-seeing principle exists in many other countries. In many parts of India we, in our unsophisticated and unenlightened manner, thought it wiser to foster than to "scotch" young and promising industries. Thus in such an industry as coffee-planting, requiring some five years or so for its fruition, the land-tax was exchanged for an export duty, which did not of course begin to operate until there were crops to export. But there must be, I assume, some advantage in being a civil administrator by profession; for one is able to follow from such a standpoint what is absolutely impossible for the merely lay intellect—the wisdom of levying, as is often done in England, at least three distinct charges upon woods, as under:—

1. Upon the revenue yielded.
2. Upon the inherent convertible value of the land which they occupy — this value being calculated upon the rateable value of the contiguous arable or pasture lands.
3. Upon the rental value for sporting purposes.

No. 2 is really such a plum of administrative ingenuity as to demand a little attention to past history. In the years 1854,

1855, 1856—I quote from 'Willich's Tables'—the price of wheat was respectively 72s. 5d., 74s. 8d., and 69s. 2d. per imperial quarter. Such temporary and unduly inflated prices—for they fell afterwards with startling rapidity—caused much land, which was not in the ordinary nature of things capable of carrying profitable crops of wheat, to be turned into arable. For this object "coppice" and woodland were hastily grabbed up, and the land laid down to the all-absorbing cereal. That was pleasantly called, and was even considered to be, "reclamation"—a reclamation which three years after, with wheat at 43s. 9d. per imperial quarter, was speedily repented of.

But I come to another stage of taxation—upward or downward, I give the reader his choice,—I mean the incidence of the death and succession duties. Not, mark, the duties themselves, but the *incidence* of them. As these are levied at present there is absolutely no limit to their recurrence. An estate, for example,—and the example is not a hypothetical one,—pays succession duties in full, the payer dies soon after, and for a second time within the same year the full succession duties are paid, or if the payment is made by instalments, these overlap so as to make the charge practically an annual one. The fate of the landed proprietor is considered to be of secondary importance, and by the very persons who wish to fix upon him the obligation of his being *non possessor sed custos solum* of his estate, and who affect to deplore the unaccountable exodus of a rural population. Continuity of policy in any branch of the estate administration is thus rendered difficult, in the forestry part of it impossible. And without continuity of policy forestry is impossible also. The *incidence* of this branch of taxation alone is not a disability merely, it is a death-blow.

The Quality of Home-grown Timber.

From this it follows that however well adapted the soil and climate of Great Britain may be to the growth of trees, the trees themselves are cut not when they are matured, but when the exigencies of the estate, financial or other, demand a provision of ready money. The woods are planted on the assumption of, let us say, an eighty years' rotation, and fellings are anticipated at certain fixed intervals to yield a certain revenue, or, to be more accurate, a certain number of cubic feet of timber available for sale in the trees being cut at their most marketable and useful stage. When this scheme is disturbed by premature and hasty fellings, the wood is forced into the market while it is still green, and the quality and price both suffer when brought into competition with the supplies of mature and seasoned timber available from abroad.

Of the Scarcity of Woodmen.

All trades necessarily become rusty by disusage, and if there are no forests to be managed on scientific principles, there are no foresters to direct, and no woodmen to fell them. The trees are consequently cut down at a convenient height for the swing of the axe, and hacked about when down without any regard to waste. Assuming that repairs are to be done to farm buildings, —and here again I do not speak without having a particular instance in my mind,—twice the quantity of trees which are necessary are felled, and a large portion of useful wood is left to rot in the ground.

If there is a large forest in the immediate vicinity, and if no adequate means of transport exist, this state of matters is bad enough, but the mischief is aggravated when the trees are intended to be sold at a distance. For not only are the uninviting trunks exposed to the critical eye of purchasers, but there is a heavy item of carriage for the transport of what is really useless and valueless bulk.

The Cost of Carriage.

I am here brought directly to another and a most serious disability. The people of Austria-Hungary, becoming alarmed at the large and increasing exportation of raw timber from their country, which, I may mention, was in especial demand by Germany, petitioned their Government for measures of protection. The foremost amongst these were export duties on timber, and *preferential rates for the carriage of the home-grown material.* I am not going to spring on my readers an impromptu attack on the "fetish" of Free Trade, but our generous, if ill-advised, policy is to give preferential rates to the conveyance of *foreign* materials and products. It is scarcely creditable to the educated intelligence of the country that this policy is permitted to exist.

The Decadence of Agriculture.

It is not possible that our great national industry of Agriculture should decline without bringing in its fall disaster more or less serious to her sister industry, Forestry. On the continent of Europe Agriculture and Forestry are held to be, and rightly held to be, inseparable companions, and are under the same department of administration. "Countries rich in agriculture and in industries," says a French writer, M. Claré, "are at the same time rich in forests. Poor countries which have neither agriculture nor industries have also lost their

forests. The Forest Chart can up to a certain point indicate to us the degree of prosperity of each country. A wooded country is a prosperous country; a country deprived of woods is a poor country. There are few exceptions to this rule."

Nor is this rule without its examples in England. In a letter addressed to the present writer, the late Lord Winchelsea pointed out that "in many districts, however, the decay of agriculture carries with it a cessation of the demand for underwood. On my estate in Kent, which I have since sold, I had 1200 acres of wood, very well managed in regular rotation, the produce of which averaged, until recent years, at least £700 a-year, and about 50,000 trees a-year were planted. Now, since the hop industry has been ruined by foreign competition, it is not worth £250."

The Security of Outlay.

I shall pass over lightly and without comment the want of security in investing money in Forestry. This is the tendency, if not the aim, of the speeches of a certain class of politicians, and it is hostile to the undertaking of all permanent improvements alike by proprietors. In what way this is likely to benefit the country, and to "fix" on the land a rural population, I confess I am unable to see.

Conflicting Interests.

Within the area apportioned to forests, the rearing and maintenance of the trees should be made the object of paramount importance. If this is not the case the hands of the forester are tied, and the industry itself fatally handicapped. Forestry brooks no second mistress within the limits subject to her sway. Again I speak from personal experience; for when the infant Forest Department of Madras, *quorum pars fui* under Dr Hugh Cleghorn (the "Father of Scientific Forestry in India," as he is called by Sir George Birdwood), assumed the nominal charge and protection of the forests, they found themselves confronted by every kind of rights of "user," which was specially advanced by the religious bodies. That the Department was under such circumstances enabled to make any headway at all was not the smallest, although it was perhaps the most obscure, of the honours which she has since won in the field of political administration. But such a precedent cannot be followed in this country where the woods belong to various owners. No outside rights can exist in scientifically managed forests, no conflicting interests can be tolerated. The same cover does not rear to the best advantage foxes and pheasants.

The Want of Forest Accounts.

So far as I have been able to find out, there is no series of reliable accounts, applying strictly to the financial results of long-existing forests in Great Britain, available for guidance and reference by intending planters.

In the case of Dashwood *v.* Magniac, a case which dealt with the powers of a liferenter over woods and the discrimination between annual and capital values, it was shown that during the lifetime of one of the liferenters the yield had been on an average £1700 per annum. The woods covered 1000 acres, and had been cut in regular rotation, a ready sale being found for the produce amongst the chairmakers of the district for the purposes of their trade. The books of the estate had been gone over by a well-known land agent, who was satisfied that this amount had been fairly taken with due regard to the maintenance of the capital value. This was, it must be remembered, in a special locality, where the wood (beech) reached the merchant's hands within a mile or so. But even here there was no statement of the value at the beginning, or of the amount left at the end.

Coming to Scotland, we find it also stated that a sum of 10s. an acre of profit had been secured by the growing of larch, the ground upon which it had been grown not being worth more than 20s. an acre in fee-simple value. But here, again, there was no stock-taking at the beginning and the end to afford guidance for the outlay of capital.

Speaking generally, the woods of an estate are treated as adjuncts, and not as separate properties. If timber, for example, is required for buildings or fencing, the wood account is not credited with its value. And the increased rental value of lands lying immediately contiguous to newly formed woods is carried to the general account of the estate, and not placed, as it should be, amongst the receipts earned by the woods. And yet this increased rental is as much revenue yielded by the plantation as is the price of the "thinnings."

Other Disabilities.

Of the more obvious disabilities attaching to the planting of woods I have not thought it necessary to speak in detail. For no one can be ignorant of the destruction periodically caused to standing woods by recurrent gales, which create a glut of fallen timber not saleable at any price.

Forest fires, often caused by matches, sparks from engines, &c., have formed a subject of special representation to the Min-

ister of Agriculture, and from the difficulty of obtaining redress may conceivably demand the cost of separate insurance.

Ground game, especially rabbits, diseases, including the notoriously destructive larch canker, insects, &c., combine to diminish the chance of profitable planting.

The Inaction of Government.

In the absence of Forestry accounts being available as a guide to intending planters of woods from private sources, there is in most foreign countries a Bureau of Intelligence with regard to Forestry from which all necessary data are readily supplied. In our own country a Select Committee on Forestry was appointed and sat during two continuous sessions, after which they framed certain recommendations which have been practically ignored. As one of that Committee phrased it, "They made a very modest application to the Treasury for not more, he thought, than £500 a-year, but they had never yet been able to get the slightest satisfaction, or any kind of assistance to advance the great national cause of Forestry."

Till within about a year ago it was possible to affirm that no official attention was given to the subject by the authorities. Not that there were no officials capable of giving practical advice upon the subject, but the carrying out of that advice within the limits of the Crown forests was impracticable. The words "Crown forests," indeed, constitute only a courtesy title, for they cover an area in which common and other rights are paramount. Grazing, turbary, and sporting do not make for—in fact, they do not permit—good Forestry. The present Commissioner of Woods, however, has been able, by demarcating a certain area within the Forest of Dean, to introduce a working plan, the operation of which will be watched by all foresters with friendly interest. And as this official, not content with availing himself simply of the offices of an Indian forester in drawing up this working plan, loses no opportunity of seeing for himself the ultimate success of such plans on the Continent, we may hope that for a future generation at least the want I have alluded to above will be supplied, and that the experimental area in the Dean Forest will open the way to larger Government effort. For if ever our increasing area of waste land is to be occupied by trees—and large portions of it can be so occupied—the way must be led by the Government. Independently of other reasons, they alone can be sure of maintaining that continuity of policy which, as I have said above, is absolutely necessary, for they alone are exempt from the fatal weight of "succession" duties. Whether they assume the task or not, it is faulty administration to stifle the efforts of individuals by the

excessive burdens of taxation which are at present incident to their enterprise in planting.

Conclusion.

Dr Edmund Calamy, in his own Life (ii. 162), says that Sir A. Gilmour of Craigmillar told him in 1710, on his remarking on the scarcity of wood, that "he was very fond of such plantations, but the people had an incurable aversion to them, having a notion that they spoiled the ground and ate the heart out of the soil;"[1] and I have personally met in England farmers who entertained the same objection to hedgerow timber, on the ground that the shade killed the grain, and that the trees harboured the bird enemies of their crops. But there is much ground which in all likelihood will no more carry crops of cereals, and there is much more ground to which the shelter afforded by plantations and the fertility conveyed by the droppings of their leaves and their "needles" will restore the heart which has been eaten out by more exhaustive crops. And if the efforts of our home politicians were directed to the lightening of the successive duties on newly planted lands—if, for example, it were enacted that *one* payment should free them for a generation from a similar tax, I am fully persuaded that the other disabilities I have enumerated could be overcome—that planting could be profitably undertaken, in view more especially of its indirect benefits to the contiguous land; and further, that with this certainty as to indirect effects, the rise in the price of timber,[2] which has apparently only just commenced, in consequence of the growing scarcity in foreign countries whence we have hitherto drawn our supplies, might enable much middle-class land (land, that is, which is not too inherently poor) to be occupied with direct financial profit by wood crops. To import *fifteen* millions of pounds sterling of *fir* timber alone—to lose the wages which the rearing and tending of this represents—to leave derelict the thousands of acres the trees would occupy, is, even in spite of the disabilities above enumerated, to succumb supinely to their incubus without making an effort to their removal either in whole or in part.

[1] See note, p. 199, vol. i., of 'Social Life in the Eighteenth Century in Scotland,' by Henry Grey Graham.

[2] Sir J. F. L. Rolleston, M.P., in his Presidential Address to the Surveyor's Institution, session 1901-1902, says, "In the midland counties, I have been furnished with accounts of timber sales at which single oak-trees have realised up to £100, while other woods are commanding good prices, and poles and thinnings are readily sold."

PARASITICALLY INOCULATED DISEASES.[1]

By E. G. WHELER, Swansfield House, Alnwick.

THE great interest that has been excited by the researches of Major Ross and other investigators on the subject of malaria in tropical climates has called the attention of the public to diseases that are inoculated by the bites of insects.

Malaria is such a dangerous and widespread malady that its investigation is naturally of general interest, and the press has consequently devoted a large share of its columns to the subject.

Other diseases in the colonies and elsewhere have perhaps excited public attention fully as much in the localities where they prevail; but as the domestic animals, and not mankind, are chiefly affected, interest concerning them is localised, except perhaps in veterinarian and scientific circles.

It is probably little known that the disease called "louping-ill" amongst sheep in the hill farms of England and Scotland presents apparently many characteristics that are common not only to malaria, but to the other diseases of the class above referred to, notably Texas fever amongst cattle.

I propose in this paper to give a short epitome of what is known of the life-history of the "grass-tick," commonly believed in the louping-ill districts to be in some way connected with the disease, and then to draw attention to some of those points of coincidence between it and other diseases apparently akin to it—viz., Texas fever, malaria, tsetse-fly disease, surra, heart-water, and yellow fever.

[1] [Since this paper was prepared for the 'Transactions,' an important step has been taken by the Board of Agriculture, announced officially as follows—viz.: "The Right Hon. R. W. Hanbury, M.P., President of the Board of Agriculture, has appointed a Departmental Committee to report as to the etiology, pathology, and morbid anatomy of the diseases of sheep known as Louping-Ill and Braxy; to make experimental investigations as to the bacteriology and life-history of these diseases, and as to their communicability, either directly or indirectly, from animal to animal; to bring together the results, if any, of the work of investigators at home and abroad; and to indicate the directions in which preventive or remedial measures are likely to be successful. The Committee consists of the following gentlemen—viz.: Professor D. J. Hamilton, M.B., F.R.C.S.E., of Aberdeen University (Chairman); Mr J. M'I. M'Call, M.B., C.M., M.R.C.V.S., Assistant Veterinary Officer, Board of Agriculture; and Mr E. G. Wheler of Alnwick. The Secretary and Demonstrator to the Committee is Mr R. B. Greig, F.H.A.S., F.Z.S., of the Durham College of Science, Newcastle-on-Tyne."—ED.]

Louping-ill and the Grass-tick.

Louping-ill is widely known in Scotland as "trembling," and is, I am told, the same complaint as that known by the name of "shivering" or "the shivers" in Lancashire and Yorkshire.[1]

It has always been held by farmers and shepherds in the affected districts that there is a close connection, though of what nature is not understood, between the disease and ticks, which are always present on the diseased sheep. Scientific investigation has established a *primâ facie* case of the probability that this view is correct, but it has not as yet been brought to such a point as to amount to anything like absolute proof, and this must be carefully borne in mind. Grass-ticks appear to be invariably present where there is disease, but they are equally found in places where louping-ill does not exist.

At the same time, so many facts bear out this hypothesis that most of those who have interested themselves in the subject feel but little doubt on the point. To avoid a frequent repetition of reservations, I shall assume, for the purpose of this paper only, that ticks are the carriers of the disease in some way as yet unknown.

In 1893 Dr Klein made a careful investigation of louping-ill on the Duke of Northumberland's estate in the valley of the North Tyne, of which he communicated a full and valuable pathological account to the Journal of the Royal Agricultural Society of that year. Other investigations have at various times been made and reported on by Professors Williams and MacFadyean, and Messrs Meik, Greig-Smith, and others, but without any practical result as regards prevention or cure of the disease.

The Grass-tick (Ixodes ricinus, Latreille).

In 1898 I commenced observations as to the life-history of the tick that is parasitic on sheep in Northumberland, and I contributed a paper on the subject to the Royal Agricultural Society's Journal in 1900.

The only species I found on sheep was *I. ricinus* (Latreille),[2]

[1] I have heard it both asserted and denied that louping-ill, trembling, and shivering are the same complaint. The point requires scientific investigation. I have no trustworthy data on which an opinion may be formed on the subject.

[2] Following Neumann's classification, I have hitherto adopted the name of *Ixodes reduvius* (Linnæus) for this species. In his 4th Memoir, just published, Neumann points out that an examination of the text and figures of Linnæus in his 'Fauna Suecica' (second edition) shows that it is the common sheep-fly or ked (*Melophagus ovinus*) that is there erroneously so called, and not, as he supposed, the grass-tick, which should therefore be known as *I. ricinus* (Latreille). The ked has six legs, whereas the grass-tick has eight, except in the larval state, when it also has only six.

locally known as the "grass-tick." It had previously been supposed that various varieties of ticks attacked the sheep. In the nymph stage they generally adhere to the faces of the sheep, and are locally called "face-ticks." The larvæ are so minute as generally to escape observation. The adult females range in colour from white to red, reddish-blue, blue, and even black, according to the extent of distension, so it is easy to understand why they have been mistaken for different species.

Another tick, *Ixodes hexagonus* (Leach), var. *inchoatus* (Neumann), was present in quantities on the shepherd's dogs, but none were found on the sheep. It is remarkable that while females of this species were numerous, no males were found on the dogs.

The grass-tick (*I. ricinus*) passes each stage of its existence on the sheep—viz., as larva, nymph, and adult—but after repletion always drops off the host either to undergo its next metamorphosis or to lay eggs. Each individual has therefore to find a fresh host three times in its existence. For this purpose it climbs the stems of rushes and other coarse herbage, and with its front pair of legs hooks on and clings to the host as it passes, or else creeps on to it when lying down.

Powers of Fasting.

Grass-ticks die in the course of two or three days if kept in dry corked bottles, but if a little damp sand or fresh moss be added they are capable of living a great length of time without food. Under these conditions they make no perceptible growth. I have kept them for the following periods:—

	Months.
Larvæ fasting	19
Nymphs "	18
Do. distended, taken August 14, 1899 (these moulted August 4, 1900)	12
Do. as adults	15

Some of the latter are still alive, having thus been in captivity twenty-seven months without food.

Another of the same batch was found, after moulting, to have no head. It is shown by fig. 3, reproduced from a photograph, which may be compared with fig. 4, representing an ordinary female having the usual rostrum, palpi, and other mouth organs.

That such a malformed creature could exist at all is extraordinary, but nevertheless it survived fourteen months in captivity, and was eventually lost by accident. This tick demonstrated clearly that fasting was absolute during that time, as under such conditions feeding was obviously impossible.

None of the above periods must be considered as maxima, as

in all cases of death the grass-ticks apparently died from want of moisture through insufficient attention.

When fully distended, and prior to moulting, both larvæ and nymphs assume a comatose condition, and I have several times supposed them to be dead. The skin is hard and chitinous, the colour is black, and the legs fully extended. After moulting, the body at first is soft and light coloured. Adult females are transparent, the body yellowish blue, with the shield black and the legs and rostrum white. After about ten days they attain their proper colours and strength. Until they have done so they remain very quiescent.

Grass-ticks when fasting emit no evacuations, except immediately after moulting; but when attached to, and feeding on, a host these are freely deposited. Of the numerous "free-living"

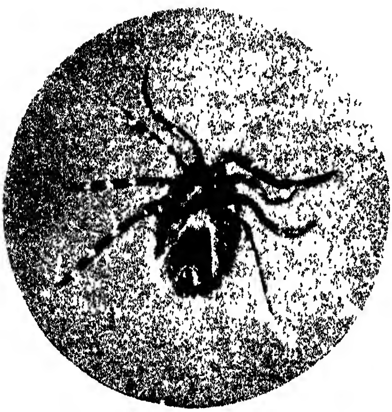

Fig. 3.—*Grass-tick, minus head.*

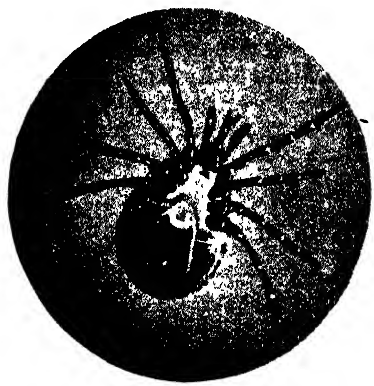

Fig. 4.—*Grass-tick, with mouth organs.*

specimens taken off herbage with a net, all were in a fasting condition.

Taking, therefore, into consideration (*a*) the power of living many months without food, (*b*) the absence of evacuations, and (*c*) the cessation of all growth and development at such times, there seems no doubt that grass-ticks fast entirely when living unattached, and only feed and develop when parasitic on a vertebrate host.

Effects of Temperature on Length of Life.

The duration of the life of ticks is very largely influenced by climatic conditions. Cold weather retards development at all stages. I am of opinion that, given a warm and genial season, grass-ticks might, under very exceptionally favourable circum-

stances, pass the whole term of life from the egg to the mature adult in one season—say from March 1 to October 15. The usual period would probably be two seasons, but under unfavourable conditions life might be prolonged for several years.

In 1897 a portion of Alnwick deer-park, where *Ixodes ricinus* is abundant, was fenced off from the deer, which are much infested by these ticks. No stock of any sort has been allowed on this ground since that date, but rabbits, field-voles, and other small mammals are fairly numerous. Last year grass-ticks were still present on this ground, but this year (1901) I could only find two nymphs after a long search, at a time when the ticks were unusually numerous in the adjoining deer-park. These probably had passed the larval stage on some small mammal, at which time the grass-ticks will feed on almost any host that presents itself. From these data it may be inferred that the removal of stock for four years is not quite sufficient to starve out the ticks, but that result would probably be achieved in five seasons.

In hot climates the duration of life in ticks is much shorter. The blue tick, *Rhipicephalus decoloratus*, the carrier of Texas fever, or redwater in South Africa, which passes its whole life on the same host, takes only twenty-one days from the hatching of the egg to arriving at maturity.[1]

Animals susceptible to Louping-ill.

Sheep and cattle are the animals known to be most susceptible to louping-ill. I am informed that geese are also subject to it.[2] Pigs are not attacked by grass-ticks, and dogs not very commonly, but the former are liable to take the disease if turned out to feed, and the latter if fed on the raw flesh of diseased animals. If the meat is cooked no bad results follow. It is supposed that pigs swallow the ticks when routing about on the moor, and thus acquire the micro-organism of the disease.

Grass-ticks are most cosmopolitan in their tastes, having been found on many mammals, birds, and even reptiles. Professor Neumann gives the following list of the hosts from which they have been taken: sheep, goats, cattle, horses, deer, roebuck, dogs, cats, foxes, ferrets, hedgehogs, badgers, genets, and man. Nymphs and larvæ are often found in abundance on lizards, birds, hares, rabbits, squirrels, polecats, moles, and bats.

[1] Dixon & Spreull, Cape of Good Hope Agricultural Journal, vol. xiii. p. 693.

[2] These birds might possibly be substituted for experimental purposes, if, as seems probable, the small mammals commonly used are not susceptible to louping-ill.

Horses and goats appear not to be susceptible to louping-ill; but little is known concerning wild animals, and information on this point is wanted.

Local Character of Louping-ill.

Louping-ill is very local in its character, a wire fence or stone wall sometimes dividing a foul from a healthy farm.

The annual loss amongst sheep bred on the ground varies much in different seasons and on different farms, but may average roughly 4 per cent.[1] When fresh stock has to be introduced on to foul ground the loss is increased to an average of about 25 per cent.[2] In some cases these figures are very greatly exceeded. The writer knows of one farm where 800 sheep were lost in one season, and another which had to be restocked three times over. The disease has been exceptionally bad during last spring. Sheep seem to be equally susceptible whether in a poor or good condition.

It is well known that sheep taken from foul land to a clean hill farm are almost sure to introduce the disease with them permanently. On the other hand, a large trade is done annually by exporting sheep from the infected hill farms to the low cultivated lands in the south for winter feeding. These sheep never introduce louping-ill, with the exception of a few occasional cases in the following spring. The ticks on these sheep always disappear.

The only explanation I can give of this apparent paradox is, that since it is proved that grass-ticks readily die of drought in confinement, it may reasonably be presumed that they are incapable of surviving on the short pasture of the lowlands, where the sun can penetrate and dry up the surface of the soil. I can only thus account for the fact that whilst grass-ticks abound in the rough herbage in Alnwick deer-park, none are to be found in the short-grassed paddocks adjoining, to which the deer have frequent access, and which is only divided off by a stone wall. This would apply still more to the turnip-lands on which sheep are folded for the winter. Ticks on such ground would have no chance of surviving. On the hill farms, on the contrary, there is always plenty of damp harbourage amongst the roots of long rank herbage, and the ticks would be permanently established. The frequent existence of non-pathogenic or harmless ticks already on the ground makes this all the more probable. If sheep containing the micro-organism of louping-ill be introduced on such ground, and if the ticks be the carriers of it from affected to healthy animals, the disease would of

[1] Inquiries made by R. B. Greig in Skye, and by myself in Northumberland.
[2] Williams, Highland and Agricultural Society Transactions, 1897, p. 279.

course spread, and it would be impossible afterwards to eradicate it. On the lowlands, on the contrary, the destruction of the ticks would necessarily prevent any further spread of the disease, if they alone furnish the means of conveying it from diseased to susceptible hosts.

The number of ticks found on sheep in the autumn in Northumberland is much smaller than in the spring, and the cases of louping-ill are few; but this does not apply everywhere, as in the warm and moist climate of Glenmoriston, in Inverness-shire, I found ticks exceptionally numerous in August. In the Isle of Skye there is an autumn as well as a spring attack of the disease every year.

Possible Remedies.

Most of the foregoing particulars were given in greater detail in the before-mentioned paper contributed by me to the Royal Agricultural Society's Journal last year. In it the following possible remedies were suggested:—

Burning and cutting rank herbage where possible.
Salt and sulphur given to sheep.
Inoculation.
Isolation of diseased sheep; and
Slaughter and burial of all affected sheep.

Subsequent information necessitates a modification of these suggestions. The use of salt and sulphur, either to prevent the attack of the ticks or as a preventive against louping-ill, proved a distinct failure. It was successfully administered to a certain number of sheep, but, as it happened, a somewhat larger percentage of them took the disease than of those in the remainder of the flock.

The isolation or slaughter of diseased sheep would be of little use until assurance can be given that micro-organisms are present only in those animals that are perceptibly ill. Reference is made farther on to a possible analogy in Texas fever, where it has been found that young calves take the disease usually in a mild or chronic form, suffering but little, if at all; but from being constantly re-inoculated by the ticks, their blood remains full of the micro-organisms, and they therefore continue to be sources of infection to susceptible animals. Although lambs frequently take louping-ill in an acute and severe form, there are reasonable grounds for suspecting that this is by no means always the case, and that the greater portion of lambs attacked may have the disease in so mild a form as not to be suspected as having it at all, but are, at the time and afterwards, owing to re-

inoculation, sources of infection to the remainder of the flock.[1] If this be so, it is clear that the slaughter or isolation of those sheep only that are perceptibly ill would avail little whilst numerous others, which appear healthy but are equally sources of danger, remain with the flock.

Analogies with other Diseases of a Similar Nature.

Several remarkable points of analogy appear to exist between this and other diseases which have been shown to be spread through inoculation by the bites of parasites and insects. Three of these, owing to their great economic importance, have been most thoroughly investigated — viz., malaria, tsetse-fly fever or nagana, and Texas fever or redwater. The latter is known by many other names. Yellow fever, surra, and heartwater may, when further investigated, come under the same category.

Texas Fever.

Of the above-mentioned diseases there is no doubt that Texas fever furnishes more data of value than any of the others. The Governments of the countries where it has proved disastrous to stock have expended very large sums on investigations by scientists. These have been carried on chiefly in the Southern States of America, in Australia, and to a lesser extent in Cape Colony.

The hosts attacked being domestic cattle, there has been a facility of observation not always obtainable. With malaria, for instance, where the host is man, experiments could not be lightly undertaken which might involve serious illness or even death. In the case of nagana, or tsetse-fly disease, the difficulty of handling the wild animals which are supposed to be the nurses of the microbes evidently deterred Surgeon-Major Bruce from experimenting on them before writing his excellent report on that complaint.

Texas fever was thoroughly investigated by Messrs Smith and Kilborne, and it is from their very exhaustive report to the U.S. Department of Agriculture[2] that the following facts have been extracted.

It was found that a mysterious disease was introduced by cattle imported from the Southern to the more Northern States. The cattle bred in the South were in good health, but the disease broke out amongst local beasts along the lines of the

[1] See pp. 24, 27, and 29 for analogous conditions in Texas fever, malaria, and nagana.

[2] 8th and 9th Annual Report of Washington Bureau of Animal Industry, 1891-92.

routes by which they travelled north, and on the pastures to which they were taken. If any Northern beasts were taken South they were also quickly affected. The disease in an acute form only appeared in the summer months, but was very deadly. Usually about 90 to 95 per cent were attacked, and in many outbreaks the mortality reached 100 per cent. It was commonly followed by a much milder attack later in the autumn. It was noticed that the Southern cattle were much infested by ticks, and that the farther the cattle were driven, and the fewer the number of ticks that remained attached to them, the less apparent was their power of introducing the disease.

This led to the discovery that the blood of the Southern cattle contained a micro-organism, a protozoon, named by Dr T. Smith *Pyrosoma bigemimum.* It was also found that these parasites were inoculated into the calves at an early age by the ticks, at which time the disease, of which the micro-organisms were the cause, assumed a mild or chronic form, and that though the calves usually suffered little, if at all, yet the protozoa continued to be present in their blood in large numbers, and the calves though unaffected themselves, were a source of danger to susceptible cattle in their neighbourhood. As these calves during their growth were constantly re-inoculated by fresh ticks, they remained pathogenic until they were sold and sent to the Northern States.

It was found that this micro-organism, or hæmatozoon, was introduced from infected to clean stock by the means of one species of tick, *Rhipicephalus annulatus,* also called *Ixodes* or *Boophilus bovis,* which was present on the cattle in immense numbers and in all stages of growth. The period of incubation of the disease was about six to ten days, and the duration of an acute attack of the disease from four to fourteen days, when the animal usually died.

The trade from the South to the North being very large, the question attracted the attention of the Government, who instituted most searching investigation.

It was found that ticks might be present in large numbers where there was no disease, but they were always on cattle that took the fever.

All experiments made have tended to show that the disease is communicated only by the ticks. The parent ticks have the power of conveying the micro-organisms through the eggs to their progeny.

The destruction of the blood-corpuscles by the hæmatozoa causes hæmoglobinuria, hence another name, "redwater," by which the fever is very commonly known. A mild or chronic form is prevalent in autumn, which is not fatal. In such cases, which generally occur amongst calves or beasts that have

previously recovered from an acute attack, hæmoglobinuria, or redwater, is never present. The period of this form of the disease is much prolonged.

The fever can readily be communicated from one beast to another by subcutaneous inoculation of blood, even in small quantities. Sheep, pigeons, rabbits, and guinea-pigs are not susceptible. The micro-organisms have not yet been identified in the ticks, owing probably to their minute size.

The cattle-ticks cannot survive the winter in the Northern States on account of the severity of the climate, so the fever has not become permanently established north of the 37th to the 39th parallels of latitude. The geographical conditions are therefore peculiar. The cattle south of this line are permanently infested with ticks, and are thereby constantly re-inoculated with the fever hæmatozoon. They are, notwithstanding, unaffected by the disease, and remain healthy, having first undergone the process of natural inoculation as calves, at which time of life the fever does not assume a virulent form.

North of this line cattle remain free both from ticks and from the micro-organisms, unless these are introduced from the South. These Northern cattle are highly susceptible to the disease.

The Legislature have therefore drawn a quarantine line across which no cattle are allowed to pass except under stringent regulations. By dipping the cattle, hand-picking, &c., a district may be cleared of ticks. On satisfactory evidence to that effect it is relieved from the quarantine regulations. These ticks die out quickly in cultivated pastures, as grass-ticks do in England, so cattle once cleared are easily kept free from them. By these means the disastrous losses by Texas fever are being greatly minimised.

In Queensland and other parts of Australia the disease is known as "tick fever." Here the climatic conditions are different, and no very definite quarantine line seems possible, but infected districts are isolated, and precautions taken similar to those in the States.

The researches of Mr Pound, Director of the Queensland Stock Institute, have led to important results, which may go far to prove the salvation of the stock-rearing industry in that colony.

Mr Pound has discovered that susceptible cattle may be rendered immune by inoculation[1] with defibrinated blood taken from an animal (usually a calf) that has recovered naturally from the fever.

By this method losses by tick fever are reduced to about

[1] Tick Fever. Technique of the method of Preventive Inoculation, by Pound.

3 per cent, which is nothing as compared to the almost total annihilation of the herds previously occasioned amongst susceptible cattle.

Whether any such treatment can be successfully applied to any of the other parasitically inoculated diseases is one of the points to which scientific research should be specially directed.

Malaria or Ague.

Public attention has been so largely directed to the important researches of Surgeon-Major Ross and other investigators in connection with malaria, that reference need only be made to the points in which they are in apparent analogy with the other diseases alluded to in this paper. It has been well known that malaria takes different forms, having defined periods of recurrence, which are known as tertian, quartan (the mildest form), and the more dangerous æstivo-autumnal form, which, being the commonest in the tropics, has been termed by Koch "tropical malaria."[1]

It is now found that the cause of these different forms of the disease are three distinct species of a very low form of animal life to which the name of *plasmordium* has been given. These first appear as minute specks of colourless protoplasm in the blood-discs, possessing the power of independent movement. As they grow they consume the blood-discs more or less completely. Those of the tertian and quartan forms of malaria assume a form known as "rosace," a rounded body bearing on its circumference little spherules. That of the tropical malaria assumes a crescent form. All three are distinguishable from each other, and each produces that form of the fever to which it belongs. The intermittent period of each fever corresponds with the maturity of its rosaces.

These hæmatozoa are introduced into the blood of man by carriers or intermediate hosts, as in the case of the Texas fever, being in the case of malaria certain species of gnats or mosquitoes of the genus *anopheles.*

Malaria was formerly common in England, but partly owing to the extensive drainage of fen and other low-lying wet lands, which has reduced but not exterminated the *anopheles,* and partly owing to the fact that quinine has been found to cure the disease by destroying the micro-organisms, it is now practically unknown at home.

In many foreign countries it is the most universal and the most serious disease with which Europeans have to contend, and

[1] It is now stated by Messrs Christophers and Stephens that the deadly black-water fever is but another form of tropical malaria.

wherever it exists the *anopheles* are to be found. The crescents of the hæmatozoa have not only been recognised in the bodies of these gnats, but they have been found to develop to maturity there, and eventually burst, discharging enormous numbers of minute elongated organisms into the body cavity, and thence eventually to the proboscis, with which the bites of the insect are inflicted.

As with Texas fever, the micro-organism is conveyed from a diseased to a healthy host; and as in that disease the blood of young calves which are healthy and thriving are found to be full of the hæmatozoa, so in malaria the blood of the young negroes is equally full of these parasites, and while thus constituting the chief danger to new arrivals, they themselves are unaffected and enjoy complete immunity. The cause of this immunity has yet to be discovered.

Malaria may be directly communicated by blood inoculation. Whether mosquitoes can convey the micro-organism through the egg to their progeny is not known, but it has been shown by Grassi that those reared from larvæ can convey the disease. In such cases the disease must have been acquired either from the parent through the egg, or in some independent manner during the larval stage, which is always passed in water.

Much of the above information is taken from the authoritative address on the subject by Lord Lister as President to the Royal Society, reported in their Year-Book for 1901.

Tsetse-fly Disease or Nagana.

This disease, so well known in South Africa, is invariably fatal to horses, donkeys, and dogs. A small percentage of cattle recover.

A very full and able report on the subject has been presented by Surgeon-Major Bruce to the Royal Society, and published by them in 1897.

Nagana renders it impossible to introduce beasts of burden into certain districts of South Africa, and has proved one of the greatest obstacles to travellers in that country. It is very local in character, and where it prevails wild animals abound. As these are driven away or killed off, the disease disappears from the locality.

As with the before-mentioned fevers, the blood-discs are destroyed by numbers of a parasitical hæmatozoon, somewhat like a minute eel, similar to or closely resembling *Trypanosoma evansi* found in the disease called "surra."

The intermediate host of nagana, the tsetse-fly (*Glossina morsitans*), is allied to the common British *stomoxys*, often mis-

taken for the common house-fly. It is supplied with a proboscis capable of biting sharply.

Major Bruce found that inoculation of nagana by flies could take place any time within twelve to twenty-four hours after they had fed on diseased animals.

The blood temperature rose 2° to 3° when the hæmatozoon appeared, and death usually followed in two or three days. Arsenic was found to prolong life very considerably in certain cases, but did not effect an ultimate cure.

The fever was conveyed directly both by blood inoculation and by eating raw flesh of diseased animals, but when the flesh had been cooked no bad effects followed.

From the numbers of flies found necessary to prove experimentally their power of carrying nagana from the "fly-ground" into a healthy locality, it seems probable that only a very small percentage contained the germs of the disease.

No hæmatozoa could be found by microscopical examination in the blood of wild beasts, but such blood inoculated in dogs frequently communicated the complaint, and after a few days hæmatozoa appeared in vast numbers, and the dogs afterwards died.

Hæmatozoa were found alive and unchanged in the proboscis of the flies nearly five days (118 hours) after feeding on a diseased host, but were gradually destroyed after that period by the gastric juices.

The period of incubation of the micro-organism is about five to six days, and that of the disease three to four weeks. Cattle, however, may have the parasite for at least eighteen months without its necessarily causing death.

Major Bruce raises the question whether young wild animals can be rendered immune by being subjected to fly at intervals, or if not, what other reason can be given why wild animals are spared whilst domestic animals, with the exception of an occasional ox or cow, are totally destroyed. The young of the wild animals could not be treated experimentally, but analogy with Texas fever and malaria would indicate that they do get immunity in the manner indicated, and an explanation is thus given to a point that has hitherto always been a mystery. Curiously enough, this view is confirmed by as old an authority as Dr Livingstone, who writes,[1] "A most remarkable feature in the bite of the tsetse-fly is its perfect harmlessness in man and wild animals, and even calves so long as they continue to suck the cows." And again, "The curious feature in the case is that dogs perish though fed on milk, whereas calves escape

[1] Missionary Travels and Researches in South Africa, by David Livingstone, 1857, pp. 80-83.

so long as they continue sucking." He adds, "Inoculation does not ensure immunity, as animals which have been slightly bitten in one year may perish by a greater number of bites in the next." Is it not probable that, as in Texas fever, calves which, as Dr Livingstone says, escape the disease while sucking, would, if continually exposed to re-inoculation by flies, resist the disease through life, though continuing dangerous as nurses of the hæmatozoa, and that this is exactly what happens with the wild beasts?

It may be objected, that if the wild beasts can acquire this immunity, why cannot the domestic animals do the same? The answer seems clear. A herd of susceptible wild animals unconsciously entering the hot moist belt of a tract of "fly" country would not only be attacked, but absolutely annihilated, with the exception only of the young which were still sucking their dams. Few of these would succumb to the disease, but those only would survive that were old enough to forage for themselves. Of these many would fall a prey to other wild beasts. Thus the residue left alive would be exceedingly small. This small residue, becoming habituated to the district whilst young, would naturally remain in the neighbourhood, and being repeatedly re-inoculated, would establish in the course of time a herd possessing a practically permanent, though really acquired, immunity. Domestic cattle would never have a chance of so doing, as the loss would be so excessive that the owners would always drive them off from the fly-country. Dr Livingstone gives a concrete instance of this. He says, "A careless herdsman, allowing a large number of cattle to wander into a tsetse district, loses all except the calves; and Sebituane once lost nearly the entire cattle of his tribe, very many thousands, by unwittingly coming under its influence." Under such conditions the establishment of an immune herd of domestic cattle would be impossible.

Dr Livingstone, commenting on the immunity of wild beasts, says, "There is not so much difference in the natures of the horse and zebra, the buffalo and ox, the sheep and antelope, as to afford any satisfactory explanation of the phenomenon."

It has been suggested that a hereditary immunity may have been established by which this, and similar diseases, are resisted by native animals in areas where the disease prevails. It appears to me that whereas immunity may possibly be developed in the course of many generations, yet at any rate we have no proof of it, and that all the evidence at present tends to show that the immunity is acquired by inoculation with the micro-organism at a time of life when, for some unexplained reason, the effect on the constitution is so slight that the young host can resist it, and is maintained only by continual re-inoculation.

Surra.[1]

Though but little heard of at home, this disease is widespread. It exists in India, Burmah, Persia, China, Brazil, various parts of Africa, and in the south of Europe.

It chiefly attacks horses and dogs, and to these it appears invariably fatal. Camels and cattle, which also suffer largely, occasionally recover.

It is believed by some to be identical with the last-named fever, nagana, but the evidence seems scarcely conclusive.

The hæmatozoa (*Trypanosoma evansi*) of the two diseases cannot be distinguished from each other by microscopical examination, but there appear to be some divergences in the nature of the complaints that may be due to difference of climate or other conditions.

Whereas the tsetse-fly is considered by Bruce to be the sole recognised medium by which nagana is communicated, Lingard believes that surra may be conveyed by the following methods: drinking polluted water, eating food containing the organism, eating rat excrement in corn, the bites of various flies, and also by the feet and beaks of crows scratching and pecking at the open sores of diseased and healthy horses when standing together.

It may be communicated by subcutaneous inoculation with the blood of animals which contains the hæmatozoa, and also by drinking it.

Another apparent difference may be noted. Lingard emphatically remarks on the voracious appetite which, even during the last moments before death, invariably accompanies an attack of surra.

Bruce lays no stress on this in cases of nagana, and even states cases where death practically resulted from starvation. Both diseases were accompanied by great exhaustion and loss of condition.

Kay Lees found the tsetse-fly in the Naga Hills in Assam, but it does not seem to be by any means universally present where surra prevails.

Whereas Bruce always failed to cure any horses of nagana, Lingard succeeded in a few cases of surra by treatment with arsenic and mercury.

The hæmatozoon is very plentiful in the blood of rats, and Dr Lingard made the remarkable discovery that donkeys, rabbits, guinea-pigs, fowls, cats, and dogs proved refractory to the rat hæmatozoon, but that all the above except fowls were very

[1] Report on Surra by Dr Alfred Lingard, vol. ii. part 1, 1899.

susceptible to it after it had first been passed through a horse.

Bruce remarks on the frequent difficulty of finding the hæmatozoon in the blood of cattle, owing to their being in insufficient numbers, though abundant in that of horses, &c. These two points may be usefully borne in mind when searching unsuccessfully for the micro-organisms of other parasitically inoculated diseases.

Heartwater.

This disease is being investigated by Mr Lounsbury, Government Entomologist in Cape Colony. He states that he has proved that it is carried from diseased to healthy sheep and goats, the animals subject to attack, by a tick known as the "bont" or "variegated" (*Amblyomma hebræum*, Koch).

The loss caused by this complaint is so great as to have depreciated the value of farms in some districts from 30 to 60 per cent.

The micro-organism has not as yet been identified, and further investigation is needed.[1]

Yellow Fever.

It is now believed that the well-known yellow fever is conveyed in a similar manner by certain species of gnats. The full reports are not yet published, and it is premature, therefore, to form any opinions on the subject at present.

Conclusions.

From the above very condensed notes of the diseases referred to, it will be seen that there are various points of agreement which have been satisfactorily proved to exist, and there are others which, though unproved, may be reasonably expected to obtain, since by them only can satisfactory explanations be given to otherwise mysterious conditions in the life-history of the intermediate host or carrier, the parasite, or of the nature of the disease.

On the annexed table, which is very incomplete, these points

[1] Mr Lounsbury writes that he has now definitely connected *Hæmaphysalis leachi* with a common and fatal dog disease called malignant jaundice. The infection in this case is conveyed through the egg as in Texas fever, but continues dormant in the ticks until the adult state is reached. In many particulars it seems closely analogous with Texas fever, but puppies seem to be as susceptible as old dogs to its attacks.

of agreement are shown by "× ×." Blank spaces show where no information has been forthcoming. Disagreement is indicated by "0."

PARASITICALLY INOCULATED DISEASES.

Disease.	Intermediate Host.	Disease a fever in both chronic and acute forms.	Micro-organism a hæmatozoon found in host	Discovered also present in intermediate host, or carrier.	Conveyed by carrier from a diseased to a healthy host.	Disease may be conveyed by eating raw diseased meat.	Disease may be communicated by blood inoculation.	The young of host may suffer little from the disease, but remain dangerous afterwards as a source of infection through the bites of insects or ticks.	The carriers not naturally poisonous, therefore only producing sickness when infested with the micro-organism.
Louping-ill .	Grass-tick (*Ixodes ricinus*)	× ×			×	×			×
Texas fever .	Cattle-tick (*Boophilus bovis*)	× ×	× ×		× ×			× ×	× ×
Tsetse-fly disease	Tsetse-fly (*Glossina morsitans*)	× ×	× ×	× ×	× ×	× ×	× ×	×	× ×
Surra . . .	Various flies	× ×	× ×	× ×	× ×	× ×	× ×	×	×
Heartwater .	Sheep-tick (*Amblyomma hebræum*)	?			×		×	0	×
Yellow fever	Various gnats				×				
Malaria . .	Mosquitoes (*anopheles*)	× ×	× ×	× ×	× ×	× ×	× ×	× ×	× ×

× × Means complete and well-established confirmation.
× Means confirmation of less established character.
0 Means an opposite conclusion.
? Means doubtful.

At the present imperfect stage of our knowledge it is clear that the contents of the table can only be taken at their proportionate values. Those most to be depended upon are no doubt Texas fever, malaria, nagana, and surra. Those relating to louping-ill, heartwater, and yellow fever need confirmation.

It appears remarkable that amongst the many points of agreement shown on the table, I have met with only one of definite and another of doubtful divergence. The blanks left always mean lack of information.

In no case is the parasitic tick or insect poisonous in itself, but is merely the intermediate host or carrier of a micro-organism, which is the real cause of the complaint, from a diseased to a healthy mammal or ultimate host. In each case cited, so far as is yet known, the micro-organism is a low form

of animal inhabiting the blood (hæmatozoon), and in no case is it a bacterium, or belonging to the vegetable kingdom. That in no less than four cases out of the seven alluded to, it has been shown that the young of the host, whether human or animal, can generally resist the disease, and by reason of repeated re-inoculation can remain immune so far as evil effects are concerned, but that their blood remains full of the organisms, and they are therefore a source of danger to other mammals that are susceptible.

In Texas fever the micro-organisms can be conveyed from the parent tick to its progeny through the egg; but there is reason to suspect that if a tick which contains hæmatozoa attaches itself to a non-susceptible host, it will become cleared of the organism, and its progeny will be harmless. It will be worth while to discover whether this may hold true in the case of louping-ill, the carrier of which, the grass-tick, only passes one stage of its life on each host.[1] If true, it would afford a reasonable explanation why the disease was uncommon in Inverness-shire, where I found the ticks in extraordinary numbers, and the climate in autumn hot and moist. Sheep and cattle, the most susceptible hosts, were small in number in comparison with horses, deer, &c., and if it were necessary for promoting the disease that the micro-organism must be conveyed direct from a diseased to a healthy host by the tick, the scarcity of the complaint is accounted for, as doubtless in most cases a horse or deer (which are believed to be not susceptible) would be seized on by the tick after leaving a diseased sheep, before an opportunity of attaching itself to a beast or healthy sheep had offered. It would also assist to account for the curious but well-known fact that a wire fence or stone wall is often sufficient to divide permanently a foul from a sound hill farm, since ticks must often pass across such a boundary as parasites on small mammals. If the latter are non-susceptible and the tick loses the micro-organism in consequence, the difficulty is to some extent explained, taking into consideration the countless casualties that must happen to a species of tick that, like the grass-tick, leaves the host between each moult.

Both in the case of Texas fever and louping-ill the stock are reared on "foul ground," by which is of course meant land where the disease is present. In each case the stock is exported in great numbers, but with opposite results. In America the fever is spread broadcast wherever the cattle are sent. In England, as before stated, no signs of illness are to be found in the sheep after they are removed, with but rare exceptions, and these always in the following spring.

[1] Experiments with "heartwater" so far tend to show that this does not hold good as regards the carrier of that disease.

These facts may be explained. The English sheep are moved only in autumn, and on to cultivated land, where the ticks rapidly die out, and no source of infection any longer exists.

In America the ticks, after the removal of the cattle, are able to lay their eggs, and a crop of pathogenic progeny are hatched out, and are able to spread the disease before they get killed by the severity of the ensuing winter months.

The acquired comparative immunity of mammals that have been inoculated when young, though the reason is not understood, gives a possible explanation why fresh sheep stock suffer so much more heavily when first brought on to foul ground, whilst the stock reared on the ground escape much more easily. It is confirmed by hill shepherds, who aver that lambs once attacked rarely suffer severely afterwards. Of course there are exceptions to this immunity amongst young stock. Such are referred to by Smith in the case of Texas fever, and young lambs are often victims of louping-ill.

I may say here that I think it probable that a large number of the ticks on our farms are harmless, not containing any micro-organisms, and that only a portion of the sheep on foul ground are ever exposed to the disease. This is only surmise, but it agrees with what is shown to be the case with the tsetse-flies, as before mentioned.

The tendency of the facts already discovered, as well as the many possibilities which need further investigation, seems to be that at least sufficient analogy exists between these diseases to render it most advisable for students to make themselves well acquainted with what is known of kindred complaints in other parts of the world. At best our knowledge regarding them is as yet very elementary, but where apparently insuperable difficulties occur in the investigation of one disease, very often explanations, which may possibly prove to be correct, will be forthcoming from analogous cases.

At the same time it is not to be expected that these analogies can be carried beyond a certain point. Variety in the conditions of the life-history of the host, the carrier of the parasite, and the parasite itself, must materially affect the details of various pathogenic diseases of this character.

It seems probable that diseases that are parasitically inoculated will divide primarily into two classes:—

(*a*) Those in which the carrier of the parasite is a true intermediate host—viz., a host in which the micro-organism necessarily passes certain stages of its existence.

(*b*) Those in which the parasite does not necessarily pass one or more of the stages of its existence, or undergo metamorphosis, in the carrier.

Malaria comes under the first of these forms of disease; tsetse-fly disease apparently comes under the second. As regards the others no precise information is as yet forthcoming. Until such material points as these have been cleared up it will be impossible to know where to anticipate analogy in regard to other points under observation.

Moreover, diseases of the first order would probably depend on a special species of carrier for their dissemination, against which preventive measures might be attempted; whereas those of the second order might be carried, in various ways, and by many varieties of carrier, against which preventive measures would be almost impossible.

It is to be regretted that the study of louping-ill, whatever may eventually prove to be the nature of the complaint, has not been considered within the scope of the schools of tropical medicine, as had it been undertaken by those specially skilled in such investigations, not only might a preventive have been found for the benefit of a very large farming industry at home, but probably further useful facts might have been gleaned to assist the investigation of diseases abroad.

It is hoped that these remarks, made merely from a practical, and not a scientific or medical, point of view, may help to draw further attention to a most interesting and important subject.

HALF A CENTURY AS A BORDER FARMER.

By John Wilson, late of Chapelhill, Cockburnspath.

In response to a friendly note from the Secretary of the Highland and Agricultural Society, requesting me to favour him with a few notes of my experience and practice as a Border farmer, for publication in the forthcoming volume of the 'Transactions,'—and participating in the hope expressed, "that it may prove interesting and useful to the younger generation of farmers,"—I have pleasure in complying with his request.

My experience, extending over the latter half of the century recently closed, embraces agricultural and pastoral farming in the counties of Berwick and Haddington, principally in the farms of Chapelhill and Tower; the latter of which was held for upwards of a century by four generations of my family. This farm has a historical interest, regarding which a few sentences may not be out of place. It derives its name, Cockburnspath Tower, from an ancient fortalice, now in ruins, con-

tiguous to the farm. We read that David, son of Malcolm Canmore, in 1125 A.D., gave a commission to the Earl of Dunbar and March to extirpate a band of robbers who had their stronghold near the pethe or pass of Colbrandspethe, and, as a reward for his having produced the head of their chief to the king, he granted him the lands of Coldbrandspethe, on condition of his keeping the marches free from robbers, and with this view the castle or fort was built and garrisoned. Again, it appears that in 1434 it was forfeited to the Crown on account of the treason of the Earl of March. In 1502 James IV. married Margaret, daughter of Henry VII. of England, and the lands of Cokbrandspeth were settled on the queen as her dowry. The village cross, still in good preservation, corroborates this fact, having thistles and roses as its capital. After James's death at Flodden, Margaret married Earl Douglas; and we find in 1584 Archibald Douglas ordered by the Privy Council, under pain of treason, "to deliver the castle of Cokbrandspeth to the king's officers." Again, in 1650 Oliver Cromwell writes to the English Parliament, "The enemy had seized the strait pass at Copperspeth, where ten men to hinder are better than forty to make way." The lands were granted by James VI. to Arnot, his treasurer, and now they have been in possession of the Hall family for two hundred years. The castle is the "Ravenswood" of Scott's 'Bride of Lammermoor,' Wolf Crag or Fast Castle being four miles eastward, on a precipitous rock overhanging the sea. But from this digression I return to my theme.

The Corn Laws.

While yet at the parish school I can remember hearing discussed the burning question of the Corn Laws, and after their abolition, the fall in the price of grain, &c., which bore so hardly on many farmers, who, without taking into account the possibility of the free importation of grain, and the competition they would have to meet when our ports were opened to the foreigner, had entered into nineteen years' leases, the result of which proved the ruin of many industrious men. It was a few years later, when the price of grain was rising in anticipation of war with Russia, that I entered on the work of the farm, after two or three years' training in an office to acquire a knowledge of bookkeeping and of general business.

The Holding.

To assist the general reader in understanding what follows, I shall give a brief description of the farm and mode of management. The holding, consisting of the two contiguous farms,

each having a separate steading, lies in the north-eastern corner of Berwickshire where it marches with East Lothian, and is within half a mile of the sea. The low-lying or better class land is above the Old Red Sandstone, being a continuation of the Dunbar red soil, famous for the growth of potatoes. The higher and less valuable land lies above greywacke or clay-slate. The whole extends to 850 acres, 550 of which are arable and the remainder pasture.

Houses, Rotation, Live Stock.

The steadings were of sufficient size to feed from 50 to 60 cattle in open courts; but were in due course modernised with covered courts, turnip-stores, implement-sheds, and other houses. Each farm had a steam-engine and threshing-mill, and cottage accommodation for the whole staff of the farm, twelve cottages in all.

The rotation and mode of management was that generally practised in the eastern Border counties—viz., the five-course shift of two years' pasture, followed by turnips or other green crop, and wheat or barley.

The live stock consisted of 200 half-bred ewes, and 6 or 8 cows, rearing 30 to 40 calves. The produce, both sheep and cattle, were fed off at two years old, then weighing from 80 to 90 lb., and 50 to 55 stones respectively. In addition to these, other stock were bought and fed off, and each man on the farm owned a cow, for which he got keep in summer and winter as part of his wages, and the service of a good pedigreed bull kept on the farm, for which no fee was charged, on the understanding that the master got the first offer of the calf at current market price. The cow-keepers in villages and non-rearing farms got the use of the bull on the same terms, which furnished the requisite supply of calves, at a price ranging from 20s. to 30s. at ten days old.

Servants' Wages.

The ploughmen were hired for twelve months from Whitsunday, and their wages were paid almost wholly in kind—viz., 100 stones oatmeal, 72 stones barley, 27 stones pease, 1800-yards drill of potatoes (they supplying seed and hand-labour), a house and garden, privilege of keeping a pig, which provided manure for his garden, cow as above mentioned, victuals in harvest, and £3 to £4 in cash. But the house at that time, and several years after, was not rent-free, for each man had to provide a "bondager" or woman worker throughout the year at the wage of 10d. per day for nine months and 8d. for the three winter months, and as house-rent she (or failing her the man's

to put in shallow drains is a penny-wise and pound-foolish policy. No operation on the farm requires more care and strict supervision, and will more amply repay it, than drainage. To neglect this is to throw away money, and entail constant future annoyance through bursting drains and general inefficiency. In order to secure good and reliable work, I have found it best that each drainer should be responsible to the tenant, and not to a contractor, for the efficiency of his work; that the drain is of the proper depth and the level true, the bottom smooth and even, so as to secure a solid bed for the pipes; and lastly, that care is taken that each drain is properly jointed with the lead or main drain, and, in filling, that no pipes are broken or shifted. This latter ought to be intrusted only to a trustworthy man who can be relied on to check any scamping of work.

Manuring.

In no case has the advance in agriculture been more striking than in the increased application of manure, and nothing has yielded more satisfactory results. In my first experience the farmyard manure was spread over the whole turnip crop. The dressing generally amounted to fifteen or sixteen cartloads per acre, when supplemented by seaweed, of which there was a considerable supply, and which in days previous to artificial manures was so eagerly sought after that, in order to secure its even distribution amongst the tenants, it was necessary to prohibit the driving of it by night, under penalty of a heavy fine imposed by the estate regulations. Peruvian guano, then of high quality, containing 11 to 12 per cent ammonia, and half-inch bones were almost the only artificial manures used. A mixture of these, say 2 or 3 cwt. per acre, was applied to the turnip crop along with the dung. These grew fairly good crops of turnips, half of which were consumed on the land by sheep, the remainder by cattle in the courts, the cattle getting a small quantity of cake or bean-meal. This was the only manure applied in the rotation, except a top-dressing of 2 cwt. guano to the hay-break.

Manufactured manures—such as dissolved bones, superphosphate, fish and meat guanos—and special manures were afterwards introduced and used with success. Upwards of thirty years ago I began the use of German phosphate, undissolved but very finely ground, on the recommendation of Professor Grahame, London, and used it extensively and successfully, especially on newly reclaimed land, in which the large quantity of decaying organic matter in the turf acted as a solvent on the raw phosphate. This was some time previous to the published experiments of Professor Jamieson of Aberdeen, which brought the use of raw phosphate under the notice of agriculturists.

From long experience I have arrived at the conclusion that, provided you get a finely pulverised manure, containing in well-balanced proportions the necessary constituents for the growth of root or cereal crops—viz., phosphates, potash, and ammonia—in a form easily assimilated, it does not much matter from what source these are derived. I am strongly of opinion, however, that as a rule natural manures in a finely pulverised condition are much to be preferred to those treated with sulphuric acid, the latter being more apt to engender disease such as finger-and-toe and canker.

I have found that the most economical and effectual plan of applying farmyard manure is to spread it on the land direct from the courts. This applies more especially to dung made in covered courts with cake; and experience has taught me to believe that there is no land or crop to which dung can be applied which will show greater or more lasting improvement than permanent pasture, though it is often somewhat difficult to make up one's mind to divert it from the green crop.

Liming.

Forty or fifty years ago liming was a more common operation on the farm than it is at the present day. It was then looked upon as indispensable, acting as a stimulant to the productive powers of the land, when the application of artificial manure was on a much more limited scale than is now prevalent. My recollection goes back to pre-railway times, when, in the summer twilight, scores of carts might be seen on their way to the lime-kilns, where, after resting an hour or two till early dawn, the men loaded their carts and started on their homeward journey with 12 or 14 cwt. per cart, reaching home after an absence of fifteen or sixteen hours. Some idea of the expense of liming an acre of land in those days may be formed when it is considered that it entailed in many cases 100 to 120 miles' travel of a pair of horses to bring the lime to the farm, independently of its prime cost and application.

My practice in applying lime has been—

1. To grass-land in the end of summer, or early in autumn, in time to let the grass grow through it before ploughing with a moderate furrow for the oat-crop. The growth of the grass keeps the lime from dropping into the bottom of the furrow and getting too deeply covered. In this case the lime is laid down in heaps of, say, 10 tons, and spread from carts as soon as it is slacked.

2. To fallow after ploughing the stubble in early autumn, it being in this case laid down in small heaps of about 1½ cwt. each, which are lightly covered with soil, left a week or two to

slack, then spread over the ground, and immediately grubbed or harrowed to mix with the soil.

3. I have always kept a compost-heap, composed of road-scrapings, ash-pit refuse, and earth carted at spare times, which, after being mixed with lime, formed an excellent top-dressing for permanent pasture.

On these lines I have applied over 7000 tons of lime to all kinds of land, ranging in value from £4 to as many shillings per acre, and in every case the expenditure was more than recouped. Indeed in many cases the liming was compulsory, the alternative being the loss of the turnip crop from finger-and-toe, for which liming would seem to be the only cure.

Of the latest form of liming—viz., the frequent application of ground lime in small quantities—I cannot speak from experience; but if the small quantity applied has the wonderful effect claimed for it, the discovery is a most valuable one to agriculturists.

Reclamation of Land.

Latterly I acquired several farms, chiefly pastoral, in a high district, and on these I had for twenty years considerable experience in breaking up and improving heather and rough pasture. The first part of the operation was of course draining it where necessary, with a 2-inch pipe, 3 feet deep. The land was then ploughed with a 6- or 8-inch furrow in the early autumn, left to lie through the winter till partially rotted, well harrowed in early spring, and then limed at the rate of 4 tons per acre. I found it better not to plough again till the turf was sufficiently rotted, then the harrows and pulveriser were liberally used in May or June, to secure a sufficient mould for sowing turnip or rape seed. The turnip or rape seed (2 to 3 lb. of the former and 6 lb. of the latter per acre) was sown broadcast, sometimes accompanied with a few pounds of Italian ryegrass. I always gave a liberal allowance of slag or superphosphate and ammoniacal manure, and in this way I generally got a better crop than could have been grown by a drilled crop on the same land, and at a greatly less expenditure in labour. The crop was eaten on the ground by sheep, and the land was afterwards cross-ploughed, cutting through the partially rotted furrow, in preparation for another turnip crop.

A second or spring furrow, with the aid of grubber and pulveriser, made it ready to sow a drilled turnip crop in June, which generally resulted in raising a big crop, for the quality of the land. This crop of roots was eaten off with sheep getting cake. The land being then thoroughly tramped, and the old turf fully rotted, was ploughed very lightly or only grubbed, to keep the manure on the surface, within reach of the seeds.

These were sown early in May: permanent grasses, and clover mixed with 1 bushel of oats or barley, and 2 lb. of rape, to afford shade for the young seeds. It was ready for pasture in August, and would keep six or eight lambs per acre for six or eight weeks; but, to prevent damage by winter frost, care was necessary not to eat it too close, or too late in the season. The second year's grazing was generally exceptionally good, the grass coming early and luxuriantly, from the quantity of manure on the surface.

I have treated 600 or 700 acres in the above manner: some of it I have left in grass continuously, some of it I have broken up after eight or ten years in pasture, and grown two or three crops of turnips in succession before laying it down to pasture again.

Treatment of Grass-Land.

If my experience entitles me to offer an advice in laying land down for pasture it is this: "Do not exhaust your land by growing grain crops, but lay it down in the highest possible condition, and keep that up, or add to it by the liberal use of cake, especially during the first three or four years, by which time it will have got into the condition of permanent pasture and may keep itself; but in any case the continued use of cake will pay. No crop grown will more surely and quickly respond to liberal treatment than pasture, and no farmer ever had a big cake-bill and a poor farm. Some years ago I divided a field of grass and pastured it with sheep, one lot getting no cake, and the other as much as they would eat. The following crop was potatoes, treated alike on the whole field, and when I sold them on the ground, the half on which the cake was eaten realised £10 per acre more than the other, repaying the cost of the cake twice over.

Live-Stock Feeding.

This source of revenue has ever been the largest and most important in the district, and on the class of farms of which I have had experience. It has proved the sheet-anchor of the farmer in enabling him to weather the storm of agricultural depression consequent on the low prices of farm produce occasioned by foreign competition. Like the majority of Berwickshire farms, mine was mainly self-supporting — that is, the sheep bred on it were also fattened. In my earlier experience the sheep were kept till they were two years old, being fed on grass and turnips, with little or no artificial food; but by the increasingly liberal use of the latter the period of maturity was gradually advanced throughout the district, and I well remember it being thought little short of a miracle that clipped

hoggs fifteen months old had been sold fat weighing 72 lb., while now many are sold at nine months, giving a still heavier weight.

The sheep of the district are the half-bred Leicester-Cheviot ewes, which are put to a Leicester, or in some cases to a Shropshire, Oxford, or Suffolk Down tup, and this results, where the treatment is liberal, in 60 to 80 per cent of them producing twins. The earliest and best of these are sold as fat lambs, fetching for 50 to 60 lb. live-weight 40s. to 45s. in the early part of the season, and later on 30s. to 35s. The ewe is generally fattened off after her fourth crop.

On the higher pastoral farms the breed is Cheviot or black-faced, sheep of hardier constitution and better adapted to a high climate. These are generally crossed with a Leicester ram, and the ewe lambs command a high price in the market as breeders. The wedders are also in good demand for feeding, and when fat bring the top price as mutton.

The practice of Berwickshire as a cattle-breeding county has entirely changed in my experience. Fifty years ago almost every farmer bred and reared a large proportion of the cattle fed on the farm. Now not one in a hundred does so, the change being gradual, and resulting from railway facilities in supplying the demand for feeding cattle from the breeding contiguous English counties, and from Ireland, farmers thus finding that it was cheaper to buy than to breed them. The fact of the farm-servants discarding their cows for a money wage had also the effect of cutting short the supply of calves, and most of those left are fed and sold as veal. Resulting from the great increase in the use of cake and other feeding-stuffs, the production of beef and mutton has increased enormously throughout the county, the increased production on the holding I have referred to being at least 100 per cent, while the cake-bill for many years considerably exceeded the rent.

Experience in stock breeding and feeding has taught me that, to do so successfully, liberal but judicious treatment is a *sine qua non*. A check, or, as it is expressively called, "a nip of hunger," is a mistake not easily remedied, and carefully to be guarded against, and all the more so that it may be going on unobserved and unsuspected alike by the owner and shepherd, if either be unobservant or inexperienced. The symptoms show themselves as clear as noonday to the experienced eye, while the uninitiated only discover them when the sheep begin to die, and then it is too late for remedy.

The crucial period for young stock, especially sheep, is the first month or six weeks after weaning. Hay-stubble or foggage, with a moderate allowance of mixed artificial food, commonly sold as lamb food, is the most suitable treatment; but

in many cases foggage cannot be provided for the whole flock. In any case the pasture must be clean—*i.e.*, not grazed with sheep for some time previously. I have for the last twenty years grown from 5 to 10 acres of early York cabbages, and found them the most valuable crop on the farm for lambs in the month of August, 1 acre of cabbage for this purpose being in my opinion worth 2 acres of the best turnips that can be grown. One cabbage per day for each lamb on fair pasture is sufficient, and at that rate an acre, growing 12,000, lasts a long time. Lambs take to turnips very readily if a few are mixed with the cabbages when these begin to run short.

The above remarks apply equally to young cattle. Keep them going on steadily, giving plenty exercise, and not too much concentrated food. In putting in cattle to feed in the autumn, I have found it a good plan to give them a run out to the field during the day, a little cake or hay being allowed when they come into the courts at night. That is better than at once confining them in courts on full turnips and a full allowance of cake, for this often brings on founder, a complaint which is almost incurable.

Working and Management of the Farm.

Little change has taken place as regards cultivation, except in the preparation of the land for green crop. At one time it was the universal practice to give a winter furrow of 8 or 10 inches, followed by a spring furrow of at least equal depth, well harrowed, grubbed, and rolled, to secure a good mould for turnip-sowing. It was, however, found in practice that, with improved cultivators, grubbers, and pulverisers, a better result could be attained, while preserving the "natural sap," the loss of which under the old system often resulted in an irregular braird, and consequently spring ploughing is now almost obsolete. The main differences in the crops grown are in the curtailed area of wheat, and the substitution of barley, the latter having of late years proved more remunerative; and the greatly extended area of the potato crop, consequent on facilities of railway and steamer transit, which opened up London and other markets. The area of potatoes grown in my own experience was at first 5 to 10 acres, latterly from 70 to 80 acres. Most of the high land, broken up in times when the price of grain was high and that of labour low, has been laid down to permanent pasture, as less expensive and more profitable; and this course has also been followed in the case of many low farms where the land was of a secondary class—indeed it is almost the rule to find a pair of horses or more dispensed with on such holdings.

The increased expense and scarcity of labour have necessitated

the laying down of land to grass, and will likely do so to a still greater extent in the near future. It is therefore now more than ever necessary that farmers, and especially young farmers, should be thoroughly versed in all the work of the farm, and capable of seeing that the utmost economy is practised, and that the labour is what it ought to be both in quantity and quality.

Hints to Young Farmers.

In my early experience, finding such knowledge and education indispensable, I took the following steps to attain it, and this plan I would recommend to the consideration of all young farmers who want to make themselves masters of their business. For several years I kept a diary, in which I entered the work of every hand and horse employed on the farm, and the names of the fields on which the work was done, the dates of beginning to sow the various crops, remarks as to the various stages of their growth, the duration and result of harvest operations, adding an estimate of the produce of each field, in order that it might be checked by the ascertained out-turn of the grain, hay, potato, and turnip crops over the bushel or steelyard. Similar entries and observations were made regarding the live stock on the farm, noting the numbers pastured on each field, the quantity of cake consumed, the estimated progress made, &c. A neighbouring butcher, who slaughtered for the London market, kindly allowed me to see his animals alive, and form an estimate of their carcass-weight, and afterwards to see them weighed in carcass. A course such as the above will enable any practical farmer to form a pretty correct idea of the cost and time necessary for every operation on the farm, the produce and value of the various crops grown, the time a field of grass or turnips will keep a certain number of sheep or cattle, and the weight and value of these when ready for the market. The experience thus gained has been both useful and profitable, it having enabled me to sell the whole produce of the farm and to buy the necessary live stock personally, saving a considerable sum in commission.

I may add that during all the time I have been in business as a farmer I have sold my fat cattle to the same firm of English cattle-dealers, and we never entered on a transaction but it was completed to our mutual satisfaction. My relations with the firm who have bought my sheep have extended over a like period, and been as satisfactory. This was the practice fifty years ago, and had it been adhered to, such episodes as the "butchers' boycott" could never have occurred.

Farm Figures—A Comparison.

The variations which have taken place in prices and in the cost of labour during the last half-century are very striking, as shown by the following list of prices for which I have sold the articles named, and of the figures relating to wages, &c.:—

	Highest.		Lowest.		
	s.	d.	s.	d.	
Wheat . . .	90	0	21	0	per quarter.
Barley . . .	50	0	22	0	"
Oats . . .	40	0	18	0	"
Potatoes . . .	200	0	20	0	per ton.
Turnips . . .	25	0	5	0	"
Hay . . .	135	0	45	0	"
Beef . . .	10	6	6	0	per stone.
Mutton . . .	1	0	0	5½	per lb.
Wool . . .	0	30½	0	6½	"
	£	s.	£	s.	
Ploughmen's wages .	54	0	30	0	per annum.
Shepherds' " (in kind)	65	0	35	0	"
Blacksmiths' contract .	7	10	3	10	per pair.

Other tradesmen's accounts have increased from 40 to 60 per cent, and public burdens in the same ratio.

Agricultural Legislation.

Considering that agriculture is the largest and most important industry in the United Kingdom, it cannot be averred that its interests have occupied an undue proportion of the attention of our legislators, or that the national funds have been too lavishly spent for its benefit. The changes in the laws affecting agriculture during the period under review are not very numerous, but are not unworthy of notice. First, there was the "Abolition of Hypothec Act," which was passed after a keen struggle to retain a relic of feudalism which gave the landlord an undue preference over the general creditors of a tenant, and in certain circumstances empowered him to seize for rent goods which had been honestly paid for by a buyer acting in good faith. This was followed by the "Ground Game Act," passed avowedly to enable a tenant to protect his crops from damage by game. That in its turn was followed by the "Agricultural Holdings Act" (1883), which at least admitted the principle that a tenant is entitled to compensation for his improvements; and lastly there came the Agricultural Holdings Amendment Act of 1900. All these measures were passed after being the subject of inquiry by a Royal Commission, that unfailing resort of a Government anxious to delay a measure which they are unwilling to pass but cannot ignore.

The laws relating to prevention of disease and importation of

cattle have been often before Parliament, and the effect has been to reduce disease amongst our flocks and herds to a very great extent.

The "Agricultural Rating Bill" removed to a certain extent an injustice to an overtaxed industry, and the extension to farm-servants of the "Workman's Compensation Act" has put that class on the same footing as their fellow-workmen.

The establishment of the Board of Agriculture was an admission by the Government of the day that the agricultural interest had a claim on their consideration; but though this was a step in the right direction, the fact remains that the money at the disposal of the department is utterly inadequate and insignificant compared with the amount spent by foreign countries for the encouragement and development of agriculture. The policy announced by the present Minister of Agriculture, followed by the appointment of a Commission to inquire into the diseases amongst sheep, &c., leads us to entertain the hope that he will succeed in making the Board of Agriculture what he says it ought to be—a means of advancing and developing agricultural science and research, and of watching over the general interest of an important industry, which is the foundation of the prosperity of the nation.

EXOTIC CONIFERS: THEIR TIMBER AND VALUE AS AN INVESTMENT.

By D. F. MACKENZIE, Morton Hall Estate Office, Liberton.

I NEED hardly explain that the term "Exotic Conifers" means cone-bearing trees that are not natives or indigenous to this country. To North America we are indebted for most of our true or needle-bearing exotic pines, and to other parts of the same country—California, for example—we are indebted for the beautiful Wellingtonia (*Sequoia gigantea*), Abies nobilis, &c.

None of the few trees indigenous to this country can in any way compare with the gigantic proportions to which these trees grow, in a comparatively short time, even in this country. To these, or many of them at least, the planter may look with confidence for a large and speedy return for his outlay. It must not be expected, however, that these trees can be grown profitably anywhere and under any conditions and environment; to attempt to do so would be absurd, and any action taken in that direction would be doomed to failure, as has hap-

pened in many instances with one of our best exotics—namely, the larch. Neither Scots fir, nor spruce, nor larch or silver fir should be discarded, however, because these will often succeed in soils and situations too exposed and barren for the newer varieties to thrive well. It is in conjunction with the older that the newer coniferous trees can be grown most profitably, with the certainty of an earlier return of the capital as well as of exceptionally high interest on the capital expended. There is thus a greater inducement for landowners to plant than there has been, leaving out of account the view taken that by the middle of the present century all timber will be at a premium through causes over which we have no control.

Reasons for extensive Planting.

There are many reasons why planting should be carried out on a large scale. In this country we have many millions of acres of waste, or practically waste, land, which gives the owners only a very limited return per acre, but which is highly suited for the production of valuable timber. We are at the present time consumers of timber to the annual value of over £31,000,000, of which we produce only £4,000,000 worth,—an extremely poor production for a country like ours. The steady increase in the population must necessarily cause an increase in the demand for timber of every sort. This, taken with the fact that our sources of supply are slowly but surely receding from our shores, must cause a very considerable appreciation in the value of timber of all classes. For some time prices have been going up steadily, and, as already stated, it is generally believed that the present generation will see most kinds of timber at a premium.

Another great inducement to look ahead and prepare for the future is that sporting rents are on the decline, and that with such facilities for rapid travel sportsmen are inclined to go to other countries in search of something new. This, with the decline in agricultural rents through the fall in the value of agricultural produce, should be a sufficient inducement to proprietors to plant on a large scale such trees as will give a rapid and valuable return, and for this purpose certain of the newer conifers which I shall enumerate later are preeminently the best.

The Conifer Conference.

Previous to the Conifer Conference held at Chiswick in 1891, the Royal Horticultural Society issued a paper asking for "a

consensus of opinion on various points." Table VIII. asked for opinions as to the conifers most suitable for timber trees in woods and forests, and each tree named below was voted upon. I name the exotics in the order in which they appear in the table thus prepared, leaving out those I do not intend to mention in this paper.

Pseudotsuga Douglasii (Douglas fir).
Abies grandis (the great silver fir).
Thuya gigantea (Thuya Lobbii or Menziesii).
Picea sitchensis (Abies Menziesii).
Abies nobilis (the noble silver fir).
Abies Nordmanniana (Crimean silver fir).
Larix europæa (Larch, common).
Sequoia sempervirens (Taxodium sempervirens).
Cupressus Lawsoniana (Lawson's cypress).
Tsuga Mertinsiana (Abies Albertiana).
Cupressus macrocarpa (Large-fruited cypress).
Pinus monticola (Californian mountain pine).

Why so few of the true pines of comparatively recent introduction have been mentioned it is impossible for me to say. It might be due to the fact that they have as a rule not been sufficiently brought forward, because it is now beyond doubt that we have very excellent timber-producers among the three sections—viz., Sec. I. *Binæ*, or those trees having only two leaves or "needles" in a sheath, and of which there are at least twenty-four varieties: type—Scots fir, Corsican pine, &c. Sec. II. *Ternatæ*, or those having three leaves in each sheath, and of which there are over thirty: type—Pinus insignis, Jeffreyii, &c. Sec. III. *Quintæ*, or those having five leaves in a sheath: type—Pinus strobus, Pinus monticola, cembra, excelsa, &c., and of which there are over thirty well known.

It is from amongst the Abies (Silver firs) and the Piceas (Spruces) we may expect to harvest the heaviest crops in the shortest space of time. Many of these, though only of comparatively recent introduction, are already of gigantic proportions. One or two of the Thuyas and a few of the Cupressus also produce large and valuable timber.

It is hardly possible to exaggerate the value of the exotic conifers as found growing in Scotland, and in support of this statement I quote what Sir (then Mr) Thiselton Dyer said when addressing the Conifer Conference from the chair on the 8th October 1891: "Any one who had not travelled in Scotland could form no idea of the extent to which rare conifers were cultivated in that country, and the splendid development to which they attained. At Murthly Castle in Perthshire, where they flourished, stately and magnificent examples were to be met with 70, 80, and 100 feet high. Such trees could

only be seen in Scotland, and were the result of a peculiar association of physical conditions. In the south-west of England it was impossible to find a parallel, although even on the sun-burnt soil of Kew good specimens of the Pinus proper were to be seen. With regard to the Abies, however,—that section of conifers of which the spruce may be taken as a type,—a state of things prevailed in Scotland which could not be rivalled in England." There is no half-hearted praise in this. Having had a good deal to do with planting and transplanting many of the conifers at Murthly, I am able to say, if any corroboration is necessary, that the trees there answered exactly the description here given. While that is so, there are many fine examples of trees to be found in England, and also in Ireland, which indicates their suitability for profitable planting if carried out upon an extensive scale under proper conditions.

Hitherto the planting of the newer exotic coniferous trees has been practically confined to small groups or specimen trees for arboricultural or gardening purposes, and this places a limit to our specific knowledge.

Rate of Growth and Yield of Conifers.

As a guide to what may be expected from plantations of the conifers mentioned, the following calculations are based upon actual measurements. The figures opposite the age are a long way under the average of those given at the Conifer Conference in 1891 (see Journal of the Royal Horticultural Society, vol. xiv., 1892), but it must be kept in mind that probably the largest trees only were noticed, and this would materially increase the average cubic contents of the trees named. And besides this fact, one could not expect the same girths at given ages over a whole plantation as one finds in solitary trees or clumps of trees; therefore the figures given may be taken as very near the average amount of timber a mixture of the trees named will produce at stated ages.

The mode of measurement is that of a cone, one-third of whose height is multiplied by one-fourth of its mean girth, which is, of course, the girth found immediately above the conoidal base of a tree, and therefore contains the gross cubical contents of the tree, but takes no notice of the difference in the cubical contents where the trees may be in the form of a truncated cone, which they will be when at the age of from 50 to 60 years. There is at present insufficient data to go beyond the 60th year, and at that it is confined to a few trees, but these clearly indicate what may be expected generally.

At 20 years of age we have an average of	2·8	cubic feet.
" 25 " "	6·3	"
" 30 " "	11·9	"
" 35 " "	20·3	"
" 40 " "	31·8	"
" 45 " "	47·0	"
" 50 " "	66·4	"
" 55 " "	90·5	"
" 60 " "	119·8	"

The above measurements refer to what may be expected of trees grown in plantation form, but to show exactly what has taken place I shall refer further to the Report of the Conifer Conference, and give the measurements there stated.

Pseudotsuga Douglasii .	gives	311	cubic feet in	59	years.
Abies grandis . . .	"	57	"	48	"
Thuya gigantea . .	"	55	"	58	"
Picea sitchensis . .	"	233	"	52	"
Abies nobilis . . .	"	174	"	60	"
Abies Nordmanniana . .	"	70	"	40	"
Sequoia sempervirens . .	"	246	"	34	"
Cupressus Lawsoniana .	"	26	"	33	"
Tsuga Mertinsiana . .	"	58	"	34	"
Cupressus macrocarpa .	"	142	"	40	"
Pinus monticola . .	"	51	"	39	"
Pinus excelsa . . .	"	120	"	50	"
Pinus Jeffreyi . . .	"	26	"	35	"
Pinus Lambertiana . .	"	60	"	43	"
Sequoia gigantea (Wellingtonia)	"	142	"	40	"

Taking these figures together, we get the high average of 118 cubic feet in the period of 44⅓ years; and if we allow, say, a crop of 60 trees to the acre, we have the gross cubical contents of over 7000 feet per acre in 44½ years; and if we can judge correctly by the rates of growth of the various trees, we might expect over 20,000 cubic feet in 60 years, worth at least £1000 per acre. But as the above calculations are deduced from the best trees throughout the United Kingdom, a return of, say, one-third less may be expected from those trees if planted in regular forests; but even 15,000 cubic feet of matured timber per acre is nearly double the crop reaped from well-managed forests. When one finds some of these pines at the age of 20 to 25 years having a height of 60 to 65 feet and a girth at 5 feet up of 5 to 6 feet, there is room for high expectations and great encouragement for the planter who may wish a safe investment against a time he may himself never see.

If we plant our newer exotics at, say, 10 feet apart, or 435 plants per imperial acre, and fill in with larch or other tree to 5 feet over all, we have 1742 trees per acre. These could stand together till the age of 20 to 25 or 30 years, according to the rate of growth and condition of side branches, when judicious

thinning may take place by removing about one-third of the number planted, say 600 trees, leaving nominally about 1142 trees per acre. At the 45th year it is more than likely that over 500 trees more may be removed, leaving about 450 trees per acre to mature as a crop. If the trees have been judiciously planted and placed as regards soil and situation, the crop at about its 50th year should be worth, at the low rate of 3d. per cubic foot, a sum of £300 per acre, while the value of that removed would exceed £140 per acre. From the examples found all over the country we can quite conceive that at the age of 60 such a plantation of, say, 400 trees would be worth more than £800 per acre—in all about £940 in 60 years. This looks a fabulous sum, but it is more than borne out by the figures laid before the Conference already referred to.

It is now beyond question that many parts of this country, especially in Scotland, are exceedingly well adapted for the profitable growth of many of the exotic conifers, the variety of soil and diversity of climate giving us a considerable range of natural adaptation. Our deep narrow glens and dells and steep rugged mountain-sides contrast very favourably with the natural habitat of the varieties afternamed. So that while we need not expect that we can produce in all cases timber of the size and quality produced in the natural home of these trees, it is not too much to expect, judging from the quantity and quality of timber we find being produced by these trees throughout the United Kingdom, that a larger volume in a given time upon a given area will be produced. Volume is certainly the first consideration, now that the preserving of timber for nearly all purposes has become so general, and that iron beams are usually used where strength and durability are required.

It is admitted that the value of the timber of the newer exotics is known only to very few. It has been proved, however, that for their durability and colour many of them are unequalled, and when we take the rapidity of growth into account they are much more valuable than any other cone-bearing tree, the larch excepted.

Value of different Sorts.

In order to give a clear idea of the values of the trees named I shall deal with them in their order. The reader may thus arrive at the proper value of each kind. I shall, as on a former occasion, take as a standard of 100 units the Scots fir. The units are arrived at by taking the average ratio of growth in a given time, and also the value per unit of timber, thus: The rate at which the Scots fir grows and its value per cubic foot = 100 units. This gives the larch a value of 216. This higher value

arises owing to the growth of the tree being more rapid and the timber being, as a rule, of twice the value of Scots fir. The proportionate value will always remain fixed, no matter what the price per cubic foot may be.

The values stated here have been arrived at after the measurements of many thousands of trees had been taken. The trees measured were selected with a view as far as possible of securing a true average rate of growth and comparative value. No notice is taken of the decorative or amenity value of any of the trees named, that being very much a matter of opinion and outside the scope of the present article.

Abies grandis.—This is the fastest grower of all the silver firs, producing valuable timber, but less in quantity in a given time than the Douglas fir. The timber is white, fairly elastic, light and easily worked, moderately durable in contact with the soil, but is unlike the common silver fir. The timber may be used for house furnishings, panels, joisting, and rafters; is specially suited for roofing, staves, heading, and all kinds of packing-boxes. It is also well suited for railway sleepers, as it takes creosoting readily. This tree should be planted in deep damp peaty-loam soil, moderately sheltered, and intermixed with Thuya gigantea or Tsuga Albertiana, these being thinned out when required and used for pitwood and fencing. Specific gravity 0·3545; ash 0·49. Value 160. Recent measurements, however, showed the tree to be in many places of a higher value, and probably 200 would be more nearly correct.

Abies lasiocarpa.—This is a silver fir which is not sufficiently known, or, if known, not so much appreciated as it deserves to be. In suitable soils and situations the timber of this tree stands in value next to that of Abies grandis. It grows exceedingly well at Durris, Murthly, Polmaise, and in several other places. The wood is white, light, soft, and very easily worked, is suitable for house furnishings as well as for the ordinary purposes for which pine timber is used. It is not known whether or not it is durable in contact with the soil; but from its texture it would appear to take in creosote quite readily. The tree should be planted in deep, cool, peaty loam. In view of the circumscribed branches the tree may be planted without intermixture. There are comparatively few trees of this conifer in cultivation in this country. Value 130.

Abies magnifica.—This tree is of very beautiful form, and very hardy in this country. The timber as grown here is not yet well known, but from the little that is known it would appear to be of a superior kind to that grown in its native habitat (Mount Shasta, California). It is rather soft, is moderately strong, and would make excellent railway sleepers. It is well adapted for house furnishings, is fairly durable as a

fence post or where the wood is in contact with moisture. In some instances the colour of the wood is like that of the nobilis, but generally the heartwood is of a reddish colour, and might be mistaken for coarsely grown redwood. The nature of the soil on which it is grown seems to govern the colour of the timber. In a deep, cool, peaty loam, having good natural drainage, the tree produces a valuable timber. Specific gravity 0·4701, ash 0·30, and value 160.

Abies nobilis.—This is a tree producing large and valuable timber, hardly so large as the Abies grandis; but the timber is harder and finer grained, and is easily worked. It is well suited for window and door framing, and also panelling, architraves, and mouldings. Unless of considerable age, it is unsuited for flooring, owing to its tendency to "scoop out" like the young wood of Swedish white wood. The summer wood parts readily from the autumn wood, and is therefore well suited for making laths. In other respects the wood is suitable for all works in which pine timber is used, cooperage included. Specific gravity 0·4561, ash 0·34, and value 170.

Abies Nordmanniana.—Although this is a valuable forest tree, it is a slower grower than any of the other Abies mentioned. The timber is harder and heavier than that of the trees named above, and in some instances resembles that of the common silver fir. It is, however, much softer, and the heartwood is inclined to colour brown, while that of the common silver fir is of a dirty whitish or grey colour. The wood may be used for all purposes for which pine timber is used. Value 125.

Araucaria imbricata.—This tree presents a great contrast to all the other conifers. It is one of the hardiest, if not the hardiest, of all the conifers introduced into this country. It luxuriates in a moist climate, and will stand almost any exposure. It is a tree not at all fastidious as to soil, provided it is deep and loose. It grows well on deep gravelly sand, but of course makes more timber when planted on deep alluvial soils.

The timber is of a yellowish or brownish white colour, there being very little difference in colour between the heart and sap woods in young trees, though in aged trees the heartwood is of a rich brown colour. The wood on the tangential section shows beautiful wavy lines, caused by the corrugations formed by the bases of the leaves. When polished it appears like American birch, notwithstanding its pine-like texture. Like the Sequoias, the medullary plates are composed of more than one line of tubes. The bark is very thick, with a large number of very large resinous canals. Large quantities of a white resin partly soluble in water are exuded through the bark at the junction

of the branches with the stem. This seems to be caused by pressure of storms and by frosts, but no harm comes to the tree. The timber is well adapted for all the purposes to which pine timber is put, and is very easily worked. Specific gravity 0·4629. Value 140.

Cupressus Lawsoniana.—The economic value of this tree is now established. It grows rapidly and produces excellent close-grained timber, which is very easily worked. It abounds in a strongly-scented resin. The timber is practically indestructible in contact with soil or moisture. In its native habitat, the valley of the Upper Sacramento, California, it grows to a huge size, from 100 to 200 feet in height, with a diameter of stem of over 12 feet.

Like many other trees, Cupressus Lawsoniana suits best on a cool moist soil, in a low and fairly-sheltered situation, interspersed with other evergreen trees requiring similar soil and conditions. When planted in suitable soil and environment in this country, it produces timber rapidly. A number of trees planted on the Morton Hall estate fourteen years ago are now 16 to 18 feet high, with a circumference at 5 feet of from 16 to 22 inches. Where properly planted, this tree promises to be one of considerable magnitude, even in this country. Plant in deep, peaty, loamy soils, in fairly sheltered northerly situations, 10 feet apart, interspersed with common silver fir or other evergreen tree, to 5 feet over all. Specific gravity 0·4621, ash 0·10, and value an average of 175.

Cupressus macrocarpa.—This is a fairly large evergreen tree from California. It makes timber rapidly in this country. It luxuriates in a deep, open, well-drained, sandy loam, near the sea or in low inland situations. It is, however, a seaside-loving plant, and will succeed well in situations exposed to strong sea-breezes. On Fota Island it is about 80 feet high, and in several places in Ireland it is of equal height with girths up to 10 feet. It is found on the west and north coasts of Scotland, growing luxuriantly. The timber is valuable for house and other fittings. It is elastic, strong, and durable, has an agreeable cedar-like odour which makes it highly suitable for bedroom furniture, fittings for furriers' and drapers' shops, &c. Its value is 283.

Cupressus nootkatensis (Thuyopsis borealis).—This is a hardy tree of fairly rapid growth when placed in a cool but not too dry or exposed a situation. It is found to grow and thrive all over the British Isles, especially in Scotland. The timber is similar to that of Cupressus Lawsoniana, except that it is a little more yellow in colour and emits a stronger and more pungent odour. To grow the tree properly it should be planted closely together, as it is liable to send out large numbers of side-shoots. When grown in the same manner as we grow Scots fir or spruce

the wood produced is of the very best quality for fencing and mining purposes. The timber is almost indestructible when used in this way, even in its immature state. Specific gravity 0·4782, ash 0·34, and value 200.

Larix occidentalis.—This is a tree of recent introduction, said to be one of the largest, if not really the largest, of the larches. It is of great economic value, and very much harder than Larix europæa, being more robust and the branches extremely thick. As it was introduced less than twenty years ago, the exact value cannot be put upon the timber, but judging from the specimens planted the tree will produce large quantities of valuable timber. I would put the economic value of this tree at 200. Specific gravity 0·6236 and ash 0·33.

Larix europæa.—This tree is so well known that I do not require to comment on its qualities. The tree when planted in suitable soil, situation, and environment is one of the most useful as well as one of the most profitable timber trees grown in this country. The timber when well grown is of a reddish-brown colour, hard, and very durable in contact with soil or damp. It is largely used for "boat-skin," agricultural implements, and cooperage. In structural works, and when used as joists, rafters, sarking, and other such works, it is very liable to twist with changes of weather, and not infrequently the plaster-work suffers. The European larch succeeds best in cool situations with a clear atmosphere, moderately sheltered, having a considerable depth of loose soil, on the sides of ravines. In such situations it grows profitably. In any situations which are flat, low-lying, and over-damp the tree is very liable to get diseased. The specific gravity is about 0·6236 and ash 0·33. The value of the timber is 216.

Larix leptolepis (Larix japonica).—This hardy species was introduced by Mr J. G. Veitch from Japan about 1861 or 1862. It is hardly such a rapid grower as Larix europæa, but under favourable conditions is nearly equal to the latter. The largest specimen at Morton Hall, planted ten years ago, is 16 feet high, very robust and healthy notwithstanding that its situation is not quite suited to its requirements. The largest specimens in this country are now from 30 to 40 feet in height. Plant interspersed with other trees in deep, cool, sandy soils having a northern aspect. From the sturdy form of its branches and thicker cortex or cortical layer it is less likely to be damaged by frost, wind, and snowstorms than the European variety. I put the tree at the same value as Larix europæa, 216.

Larix americana (Larix microcarpa).—This is a tree which, though seldom found growing in this country, is worthy of the attention of planters. It grows nearly as fast as Larix europæa,

and seems to be more hardy or free from the disease known as blister, owing to the cortex being thicker and the branches more robust. From the appearance of the timber of a few large trees I have seen cut down it appeared superior to the European variety, producing nearly an equal bulk of timber in a given time. The wood is heavy, hard, and durable, the heartwood being redder than that of Larix europæa. Plant in deep sandy soils with natural drainage. Specific gravity 0·6236, ash 0·33, and value 200.

Picea sitchensis (Abies Menziesii).—This tree of the spruce tribe was introduced from North-West America about sixty years ago, and bids fair to grow in this country to a bulk and quality of timber equal to that produced by the tree in its native habitat. The finest trees in Scotland are to be found in Perthshire, the largest being at Keilour. It is a tree nearly 100 feet in height and over 13 feet in circumference. The next largest is at Castle Menzies, if indeed it is not as large as the Keilour tree. In Ireland there are trees of equal bulk. The tree should be planted with the Douglas fir in deep, cool, and damp (not wet) soils; but as the tree is not so particular as to soil or situation as the Douglas fir, it can be planted in most moist soils or gravels if deep. It should on no account be planted on hot dry soils or on thin moory soils. Under such conditions the tree gets diseased.

The timber has the general appearance of the common spruce, but is of greater value, it being much more durable and more easily worked. It takes a fine polish, and is suitable for the commoner uses to which the white wood of commerce is applied, including house-fittings, staves and headings for making dry-goods casks, and packing-cases. When grown closely together it is suitable for herring-barrel staves, being for that purpose equal to larch. Mr Veitch suggests this tree as being highly suited for planting the waste lands of Scotland and Ireland, and I heartily concur in what he says. Wherever it is possible this tree should be planted on a large scale. Specific gravity 0·4287, ash 0·17, and value 220.

Picea morinda (Abies Smithiana).—Some people attach considerable importance to this tree, both for its timber and appearance. The timber is inferior to that of Menziesii, though very like the latter in texture. In works where the wood is in contact with the soil it is very perishable, besides being very brittle. So far as my experience of this tree goes it does not appear to possess valuable qualities. Value 55.

Pinus excelsa.—This is a tree of fairly rapid growth in sheltered situations. It must be grown thickly to produce clean timber. When properly grown the timber is good, being very resinous. When planted in exposed situations or on poor soils the tree

presents after a time a wretched ragged appearance, producing faulty wood filled with pools of resin, rendering the wood coarse and brittle. The tree would do well for mining timber. Specific gravity 0·3562, ash 0·20. Its value is 100.

Pinus Jeffreyi.—This is a hardy tree, producing strong durable timber of regular growth. It rapidly produces heartwood of considerable density. The timber is somewhat similar to that of Pinus ponderosa, but the tree appears better adapted to this country than the latter. When grown thickly together it produces excellent pit-wood, as when properly planted the tree grows rapidly with very little taper. Specific gravity 0·5206, ash 0·26, and value 140.

Pinus Lambertiana.—This tree produces excellent timber, but is little planted in this country, though where it has been planted it has attained considerable size. It requires a deep, sandy, loam soil and a slightly sheltered situation. Can be grown closely together. The timber is open, light, and resinous, and is very suitable for house-furnishings and all the uses to which ordinary pine timber is put. Value 165.

Pinus monticola.—This is one of the best white pines introduced when placed in favourable situations. It succeeds best in alluvial soils, sandy soils, *débris* of mountains, &c. It should be moderately sheltered. Few trees of the true pines can excel it for quantity and excellence of the timber. It grows with a clean straight stem, with very little taper, and is perfectly hardy. The timber, though in appearance it resembles Pinus strobus, is much superior to that timber in every respect, but more especially in strength. When grown on a free, cool, sandy soil it grows rapidly, but when the environment is unsuitable the growth is less rapid, resembling more Pinus cembra. Under such conditions the tree sheds its leaves prematurely, and seems to exude an excessive quantity of resin. The timber is of medium weight, elastic, easily worked, and well suited for house-furnishings. When cut out of season the wood is liable to be attacked by moths, but when cut at the proper season (winter) these insects do not attack it. Specific gravity 0·3865, ash 0·25, value 210.

Pseudotsuga Douglasii.—This fir may be put down as the most valuable exotic we have got, not even the larch excepted. The large bulk produced and the excellent quality of its timber are now beyond doubt. At the Conifer Conference before referred to it received the highest number of votes, as being the best timber tree for woods and forests. The timber of the Douglas fir is suitable for almost all the purposes for which the larch is used, "boat-skin" excepted, and lasts equally well when in contact with moist soils. It is very easily worked and takes a high polish. It takes creosoting well. The timber

is highly suited for house-furnishings—such as the panelling of dados, staircases, doors, and windows,—or where varnishing or polishing only is used. The rougher quality of timber may be used where painting is to be done. It does not twist or warp like the larch when used as joisting, and may therefore be used with safety and profit in the making of greenhouses or houses for all horticultural purposes,—purposes for which, generally speaking, the larch is unsuited owing to its liability to twist and warp. The wood is fairly hard, and is of the same colour as the larch and may be mistaken for that wood.

To secure the most profitable crop it should be planted in cool deep soil of a loamy nature, or any soil that is not too hot, although at Murthly Castle, Perthshire, and at Durris on the banks of the Dee, it grows admirably on deep, moderately dry, gravelly soils. It should be planted in masses about 10 feet apart interspersed with larch to 5 feet over all, the larch to be removed about the twentieth year. If the soil is warm and sandy, such as one finds on the banks of the rivers Nairn and Findhorn near the sea, Pinus laricio would be the most suitable tree to plant along with it so as to keep the soil perpetually shaded, thereby preventing undue evaporation.

If carefully planted in suitable soils and moderately sheltered situations, this tree is certain to return a sum of £3 per acre for each year the tree occupies the ground till it reaches maturity, which it appears is from 75 to 100 years. This value per acre is deduced from measurements which have been taken from trees which have been planted some time. The largest trees known in the United Kingdom are those at Dropmore, Bucks. They are over 120 feet high with a girth of 11 feet. At Lyndoch, Perth, there are trees 92 feet with a girth of 12 feet. (See Report of Conifer Conference.) The specific gravity is 0·5157, ash 0·08, and value 225.

Sequoia sempervirens.—This gigantic tree, introduced from California, in cool moist soils, sheltered, near rivers, produces a large bulk of fairly good timber in a given time. Although it was not introduced till 1846, there are some very large trees in this country, and in Ireland, reaching to a height of over 80 feet, with a girth of 12 feet. The timber is not strong, nor is it durable in contact with the soil, but it is excellent for house-furnishings and shop-fittings, such as panelling and moulding. The sapwood, of which there is only a very small proportion, is white, while the heartwood has a dark Spanish-brown colour. It polishes well, and generally can be used with advantage for ornamental joinery and for bedroom furniture, where, in conjunction with butter-nut (*Caryocar nuciferum*), it shows to advantage. The tree is well adapted for planting near the coast when not too exposed to frosty winds; a mild moist

climate suits it best. Specific gravity 0·6706, ash 0·42, and value 204.

Sequoia gigantea (Wellingtonia gigantea).—This is another of the gigantic trees from California, introduced in 1853. It is found in nearly every collection throughout the kingdom. The timber resembles in a great degree that of Sequoia sempervirens, but is much tougher and harder. The colour of the heartwood is red like that of the *Cedrus virginiana* (Pencil cedar). The wood is suited for the same purposes as the Sequoia sempervirens.

The tree grows best in conjunction with the larch in deep loose soils in sheltered situations. When planted in deep ravines it makes remarkable progress. The localities suited to its requirements are more limited than for most other conifers. Though only about 48 years old we find trees of this conifer over 60 feet in height with a circumference at 5 feet from the ground of 13 feet, and containing about 130 or 140 cubic feet of timber. This at 200 trees per acre would in fifty years be worth a very handsome sum per acre. This is certainly a tree among others worthy of the consideration of the economic planter, notwithstanding the limited range of its adaptability. The comparative value is 370, specific gravity 0·2882, and ash 0·50.

Tsuga Mertinsiana (Abies Albertiana).—This is a large tree, valuable in this country on account of its comparatively rapid growth as well as its capability of being grown closer together than most other pine-trees. The wood is of a yellowish-white colour, is elastic, and on account of its numerous and fine medullary rays presents a very fine grain. It stands the vicissitudes of our changeable climate equal to any pine timber grown. The bark is richer in tannin than that of the larch. It is the bark of this tree and that of Abies canadensis that the Americans and others use in the dressing of leather, especially that used for mechanical purposes. When planted in moderately sheltered situations in a deep peaty loam the rate of growth is rapid and uniform. Being what is known as a "shade-bearer," a crop of 300 trees per acre can be profitably matured. If grown for pitwood upon the Continental system a more profitable crop could hardly be grown. An acre of land suited to the production of this tree is capable of producing, in a period of thirty years from the date of planting, a crop of thinnings suited for pitwood of a gross value of over £80, leaving a crop to mature. If one can judge of the tree as it behaves in this country, at the age of between 50 and 60 years an acre would be worth over £400.

The value of the tree is greater than that of the larch because of its immunity from disease, but the range of soils and situation is more limited. After its twentieth year it produces cones

freely, but the percentage of germination of its seed is very low, often not exceeding 10 per cent. Old trees give a higher percentage, however. Specific gravity 0·5182, ash 0·42, and value 200.

Conclusion.

The expert sylviculturist will at once note that I have omitted many of our recently introduced coniferous trees, and also some of those of earlier introduction, such as Pinus laricio and Picea excelsa. These are, however, too well known to require notice in a paper like this. With regard to others of comparatively recent introduction, I am not sufficiently well acquainted with their timber to be able to give a reliable opinion as to their commercial value; and besides, many of those omitted are too sparingly planted, and are too young even to indicate what their value in this country may be.

There can be no doubt that the timber of our exotics is as a rule equal, if not superior, in lasting qualities to that of natives. It is not always as strong, but this defect can in a great measure be remedied by the growing of the trees under proper sylvicultural treatment. On the other hand, their timber is more easily worked, and this counts for a great deal. Besides, since iron is now so largely used for the principal supports of buildings, the strength of timbers does not enter so largely into the calculations of the architect.

It must not be assumed that I think our timber inferior to that imported. On the contrary, I have reasons for knowing that it is not one whit inferior. Having passed in review millions of feet of sawn timber of home production, I speak from experience. What is wanted, however, is a larger production of timber in a given space and time than has been obtained in the past. This can be attained by planting those trees most suitable for these objects, and by thereafter giving them proper treatment. Uniformity in treatment of growing timber is the chief defect in our forestry.

It must not be understood that it is recommended that pure plantations of the various trees noticed be planted. If such a course were adopted it would lead to disappointment. It is only in a very limited number of cases that we have areas sufficiently large to grow pure crops of any kind of timber. To secure a profitable crop, trees, like other plants, require, in addition to light, heat, and moisture, soils suited to their requirements. Therefore to secure the largest possible crop of timber from a given area the grouping system should be adopted, with subsidiary trees as nurses where such are necessary, the subsidiary ones to be removed according as the permanent crop may require relief—that is, in the proportion

which may in each case be found indispensable to the rapid formation of timber in the individual species. Thus one group may become ready for thinning sooner or later than the main or principal portion of the plantation.

If we desire a profitable crop of, say, larch, we choose a hillside near the channels of mountain streams and rapid-flowing rivers where there is probably very little soil except what is found amongst the rocky *débris* of the mountain, such as one finds in many parts of the Highlands. Then where we have damp peaty soils and deep damp gravels we plant spruce. In cool clays we plant the silver fir, and on the moor with a thin peaty soil, with clay, gravel, or gravelly sandy subsoil, we naturally plant the true pines. In large areas of land we find many kinds of soil, each of which should be planted with the variety of tree which succeeds best upon it.

ON LUCERNE.

WITH NOTES ON SOME OTHER LEGUMINOUS CROPS.

By Bernard Dyer, D.Sc., F.I.C., London.

The subject of the manurial treatment of leguminous plants is one which would probably repay more attention than has been devoted to it during late years. Experiments on the manuring of grass, potatoes, turnips, mangolds, wheat, oats, and barley have been multiplied all over the kingdom, but comparatively little work has been done in this connection with regard to the Leguminosæ. Indeed it has been too much the custom to assume that, provided the land contains, or is supplied with, sufficient phosphoric acid, lime, and potash, the leguminous crops can take care of themselves without the use of any nitrogenous manure. In support of this idea we have the accumulated experience of years with regard to red clover grown as a rotation crop, which has taught us that it is unnecessary for such a crop to give any direct application of nitrogenous manure. We have also a large amount of scientific evidence that the Leguminosæ have sources of nitrogenous food beyond those of the nitrogen previously contained in the soil. This fact was demonstrated in America by Prof. Atwater, who, however, was unable from his experiments to decide whether the nitrogen gained by leguminous plants from outside of the soil was collected by the foliage of the plants or by the soil itself. His experiments, nevertheless, were such as to lead to the conviction that the fact of the

acquisition, direct or indirect, of free nitrogen, during the growth of such plants, was well established. In 1886 came the memorable announcement of the initial work of Hellriegel and Wilfarth in the same direction, leading to the discovery of the micro-organisms in the root nodules and of their nitrogen-gathering function. In the course of the work carried out by Hellriegel and Wilfarth, and by numerous other investigators,—including the late Sir John Lawes and the late Sir Henry Gilbert,—it has been abundantly demonstrated and confirmed that, provided the suitable micro-organisms for "infection" of the roots are present in the soil, a leguminous crop "infected" with this parasitic growth becomes potentially independent of previously existing combined nitrogen, and can make excellent growth even in bare sand destitute of organic matter, provided only that sufficient moisture and the "mineral" elements of fertility (phosphoric acid, lime, potash, &c.) are present in sufficient abundance.

This discovery explained the long-recognised enrichment of the surface-soil by the growth of red clover, thought in earlier days to be due to the transfer to the surface-soil of fertilising matter gathered from the subsoil, rather than to any actual addition to the acreage quantity of nitrogen. It also explained much of the enrichment of the surface-soil in the case of permanent pasture containing an admixture of leguminous plants.

The knowledge thus firmly established where conjecture and speculation had long preceded it, seems, however, to have been taken by many of us as a basis for conclusions that have been over-hasty. Because, under certain circumstances, leguminous crops can, so to speak, "get their own living" as regards nitrogenous food, it has been assumed that they are unaided by or indifferent to combined nitrogen already existing in the soil or supplied to the soil in the form of manure; and farmers have been largely counselled by their scientific advisers that to apply nitrogenous manure to a leguminous crop is mere waste. Within certain limitations this is probably true — as, for instance, when a leguminous crop like red clover is grown in the course of an ordinary four-course rotation. In such a case it is probably superfluous to make any special application of nitrogenous manure to the clover crop, the nitrogenous manure—dung, nitrate of soda, sulphate of ammonia, fish-guano, rape-dust, or whatever it may be—being better applied to the corn and root crops, leaving the clover to make what use it can of those portions which the other crops have left unappropriated. With such residues, together with the quantity of free nitrogen it is able to gather, it is no doubt generally independent of any more direct supply. But red clover in a four-course rotation is by no means the only leguminous crop which farmers

have to consider. There are leguminous plants which are not grown in rotation, but in succession—or, to use gardening language, perennially. Such are the various clovers which form some of the natural constituents of permanent pasture, and the important permanent fodder crop, *Medicago sativa*, or lucerne, which is grown for many years on the same land—as long, indeed, as it flourishes, or until it is crowded out by the competing growth of grass and weeds.

The fact that leguminous crops are active consumers of soil nitrogen in the form of nitrates has been very clearly demonstrated in the course of the many years' systematic field experiments that have been carried on at Rothamsted on a number of crops of this type. Amongst the crops experimented on are Dutch clover (*Trifolium repens*), vetches (*Vicia sativa*), Bokhara clover (*Melilotus leucantha*), and lucerne (*Medicago sativa*). Each of these plants has been grown year after year in succession on parallel plots of land, side by side with a plot on which wheat has been grown alternated with bare fallow. To the leguminous crops only mineral manures have been applied, without nitrogen. An examination of the results of the experiments demonstrates that these leguminous plants have yielded in their crops a large quantity of nitrogen, the origin of which may be reasonably attributed to the atmosphere; and also that a considerable accumulation of nitrogen has taken place in the surface-soil as a result of the accumulation of root-residue, &c., year after year. Thus, over a number of years, we find that the wheat crops (grain and straw) grown on the wheat-land contained on the average only 12 lb. of nitrogen per acre. On the leguminous land, however, we find that the crops of white (Dutch) clover have yielded on the average 47 lb. of nitrogen per acre per annum, the vetches 75 lb., the Bokhara clover 64 lb., and the lucerne 160 lb.

Analyses of the soil made on samples drawn in 1885 (the eighth year of the experiments) gave the following results:—

Fallow-Wheat and Leguminous Land: Hoos Field, Rothamsted.

	Total nitrogen per acre in surface soil (first 9 inches) lb.
Wheat and fallow land	2706
Trifolium repens (white clover) . .	3363
Melilotus leucantha (Bokhara clover) . .	3050
Medicago sativa (lucerne) . . .	3230

The increase of organic nitrogen in root-residue is here shown very strikingly. But this accumulation of nitrogenous organic matter in the surface-soil could not very well occur without an increase in the annual production of soil nitrates, for nitrogenous

organic matter is constantly undergoing decay, and under ordinary soil conditions the chief ultimate form of decay as regards the nitrogen is the formation of nitrates. It is therefore of much interest to inquire how far the leguminous crops themselves assimilate the soil nitrogen reinforced by the decaying root-residues left by themselves. If they were indifferent to the combined nitrogen existing in the soil in the form of nitrates, we should expect to find that the unassimilated nitrates washed away or existing in the subsoil would be in proportion to the organic nitrogen contents of the surface-soil, in which nitrification mainly takes place. In the year 1885, and also in previous years,—but we need not at the moment consider the earlier results,—samples of the subsoils of the various plots now referred to were collected down to twelve depths of 9 inches each, making a total depth of 9 feet. In all of these successive depths the nitrogen existing as nitrates was determined, with the following results (Table I.):—

TABLE I.—WHEAT-FALLOW AND LEGUMINOUS LAND: HOOS FIELD, ROTHAMSTED.

Nitrogen *in the form of* nitrates (*"nitrate nitrogen"*) *in soils and subsoils, August* 1885.

(Results stated as lb. of nitrogen per acre.)

Depth.		Wheat (fallow) land.	White clover.	Bokhara clover.	Lucerne.
	inches	lb.	lb.	lb.	lb
1st	9	17·12	11·29	4·27	8·72
2nd	9	3·67	1·38	1·40	1·11
3rd	9	2·76	0·90	2·12	0·78
4th	9	2·16	1·86	2·94	0·81
5th	9	1·68	7·08	5·22	0·99
6th	9	1·47	11·31	6·21	0·93
7th	9	1·77	13·14	7·95	0·57
8th	9	1·83	12·63	10·08	0·81
9th	9	2·29	11·19	9·66	0·70
10th	9	2·01	10·70	9·16	0·61
11th	9	1·98	11·08	8·83	0·44
12th	9	2·06	9·96	10·12	0·41
Total	108	40·80	102·52	77·96	16·88

We have first the results obtained from the fallow half of the alternate wheat-and-fallow plot, representing the summer accumulation, up to August, of the natural soil nitrates in unmanured land cropped every other year with wheat. In

round numbers we see that the surface-soil contains about 17 lb. of nitrate nitrogen per acre. The three leguminous plots show respectively, omitting fractions, 11 lb., 4 lb., and 8 lb. per acre in the surface-soil.

In the whole depth of 9 feet the fallow land contains, in round numbers, 41 lb. of nitrate nitrogen per acre; the white clover land shows over 102 lb.; the Bokhara clover land nearly 78 lb.; and the lucerne land about 17 lb.

That enormously greater nitrification takes place in the leguminous land than in the wheat-fallow land is abundantly clear in the case of the white clover, and also in the case of the Bokhara clover, from the results of this examination of the subsoils. But as nitrification proceeds mainly in the surface-soil, the great abundance of nitrates found in these subsoils could not occur without very free and active nitrification in the surface-soils. Nevertheless we find, as already seen, that, in spite of the abundant nitrate production evidenced by the subsoils, the quantity of nitrate nitrogen actually found in the surface-soils at the date of this examination was comparatively small—a circumstance only to be explained on the supposition that the leguminous crops were actively assimilating the nitrates formed at the surface. The scarcity of nitrate-nitrogen in the second and third depths of the leguminous land, as compared with the fallow land, is much more marked.

The most remarkable and interesting feature, however, in the tabulated figures is the great difference that exists, as regards nitrate-nitrogen, between the subsoils of the three leguminous crops. After we pass the third or fourth depth, relatively very large accumulations of nitrate-nitrogen are found in the white clover subsoils. In the Bokhara clover subsoils the corresponding accumulations are decidedly less, though still very large as compared with those on the fallow soil. But on the lucerne plot, in no single depth of subsoil below the second 9 inches does the quantity of nitrate-nitrogen amount to more than 1 lb. per acre. The lucerne soil is practically as rich in organic nitrogen as the white clover soil, and there is no reason whatever for supposing that nitrification is less here than in the case of the white clover soil. Nevertheless, the total quantity of nitrate-nitrogen found down to a depth of 9 feet is less than 17 lb. per acre on the lucerne plot, while it is over 102 lb. per acre on the white clover plot and intermediate on the Bokhara clover plot.

The cause of this difference is surely not very far to seek. The white clover, on the one hand, is essentially a shallow-rooting plant, while lucerne, on the other hand, is probably the most deeply-rooting plant that is ever grown on agricultural land. It sends down tap-roots far into the subsoil, and will

even burrow down far away into the crevices of rock lying below. In fact, roots as thick as a goose-quill may sometimes be found 7 or 8 feet below the surface. These roots freely throw out lateral rootlets. A plant so equipped has far greater facilities for absorbing the soluble matters in soil drainage than such a crop as white clover.

When these far greater natural facilities possessed by the lucerne as compared with the white clover are compared with the abundance of unappropriated nitrate-nitrogen in the clover subsoils and the all but absence of such nitrogen in the lucerne subsoils, there seems no conclusion open to us but that the lucerne at any rate has so eagerly availed itself of the supply of nitrate-nitrogen in the soil that only trivial quantities are found in the lower depths; while even in the case of the two more shallow-rooting crops, the results found nearer to the surface point, as has been already shown, to the conclusion that these crops also largely assimilate nitrate-nitrogen.

These conclusions in no way diminish the importance of the leguminous crops as indirect collectors of atmospheric nitrogen. The abundant yield of nitrogen obtained from them year by year could not have been maintained out of the slender natural resources of the soil; nor could there have occurred the accumulations of organic residue which are responsible for the abundant quantities of nitrate-nitrogen formed on this old leguminous land. But that the crops themselves derive part of their nitrogenous sustenance from the nitrate-nitrogen formed from the root-residue of preceding seasons seems clear; and if this is so, it is a question whether those engaged of late years in experimental inquiry have not too much ignored the appetite possessed by leguminous crops for combined nitrogen, more particularly, as has already been indicated, in cases in which such crops are grown, not in rotation like red clover, but as constituents of permanent pasture, or as comparatively permanent independent fodder crops like lucerne.

In the Journal of the Royal Agricultural Society of England for June 1900 I contributed some notes on some experiments which I had then been carrying on for three years on the subject of the manuring of lucerne. These experiments are still going on, and I am able now to give the results of five consecutive years' successful growth of this crop under various manurial conditions, on a soil on which many farmers would doubt the possibility of growing lucerne under any circumstances—namely, a fairly stiff soil on the weald clay, possessed of very little "inherent fertility." It happened some years ago —at a time when, like most other agricultural chemists, I had been led, by the work of Hellriegel, Wilfarth, and others, to the

conclusion that nitrogenous manure need not be wasted by being applied to leguminous crops—that I received the information that, both in Spain and South America, nitrate of soda is freely and profitably used in the cultivation of lucerne, or *alfalfa* —which is the name, presumably of Moorish origin, by which the plant is known in countries where the Spanish tongue prevails. And as there happened to be an available and convenient piece of ground on the farm of my friend Mr F. W. E. Shrivell, of Golden Green, Hadlow, near Tonbridge (with whom I have for many years co-operated in systematic manurial trials relating to the growth of vegetables, fruit, and hops), I proposed, with his kind assistance, to sow some lucerne and to keep it under experiment and observation as long as the land would continue to grow it.

Lucerne is usually regarded as a "lime" plant—that is to say, a plant that will only grow well on a calcareous soil. From information which has reached me later, I am inclined to doubt whether there is really any need for a large proportion of lime in the soil in order that lucerne may take kindly to it, and we are now putting down some other patches to test this particular question. At the outset of the experiments, however, wishing to run no risk of a failure of plant, we spread on the soil lime at the rate of about 5 tons per acre, digging it well into the land by spade labour after the lime had become thoroughly weathered on the surface. The soil had received no dung for many years, and this initial application of lime and the spade cultivation constituted the only special preparation that it received. Four plots were marked out, each one-hundredth of an acre (48½ square yards) in area. The scheme decided upon was to manure every plot each year with like quantities of mineral fertilisers, withholding nitrogen altogether from the first plot and applying to the other three plots 1 cwt., 2 cwt., and 4 cwt. of nitrate of soda per acre per annum respectively. The mineral manures applied have been as follows:—

Year.	Mineral manures per acre.
1897	Basic slag, 7 cwt. ; kainit, 4 cwt.
1898	Superphosphate, 4 cwt. ; sulphate of potash, 1 cwt.
1899	Superphosphate, 3 cwt. ; sulphate of potash, 1 cwt.
1900	Basic slag, 10 cwt. ; sulphate of potash, 1 cwt.
1901	Superphosphate, 6 cwt. ; sulphate of potash, 1 cwt.

The mineral manure has usually been applied early in February, while, except in the first year, when it was applied in June (the plant having been sown only in the spring), the nitrate of soda has also been applied early in February.

In 1897, the actual year of sowing, we were successful in

obtaining two cuttings, though of course they were small. In 1898 we obtained three cuttings of fodder; in 1899 four cuttings; in 1900 three cuttings; and in 1901 four cuttings.

From our best plot we have, in the five years, cut nearly 80 tons per acre of green fodder—an average of nearly 16 tons per annum; from which it will at once be gathered that the experiment, as far as vigorous growth of the crop is concerned, has been practically a successful one, the crops having been sufficiently heavy to afford a good test of the relative economy of the different systems of manuring adopted.

On the first plot, it will be remembered, the lucerne—in a soil well supplied with all the mineral elements of fertility—is dependent for nitrogen upon its own natural resources and upon the small amount of nitrogen obtainable from the soil by natural nitrification. On the other three plots, under conditions otherwise the same, the plant is fed annually with 1 cwt., 2 cwt., or 4 cwt. of nitrate of soda per acre. As the soil is fairly uniform, the natural nitrification due to pre-existing organic matter may be assumed to be the same for all four plots, so that the only varying condition is the presence or absence of the nitrogen furnished in the nitrate of soda applied.

For the information of readers who care to follow the experiment in close detail, I give a table (Table II.) showing the records of each cutting of green fodder in each of the five years 1897-1901 inclusive. For greater convenience in considering the aggregate results, however, I also give another table (Table III.) showing only the total produce of green fodder for each year and the average results for the five years. In each case I have given also the total annual rainfall.

A further table (Table IV.) is given, in which the yield obtained from mineral manures only is deducted from the total yields of plots A, B, and D, giving the excess or increase of crop produced by the use of nitrate of soda.

It will be seen that in five years an annual dressing of 1 cwt. of nitrate of soda per acre has given us an increase of over 14 tons per acre of green fodder, or nearly 3 tons per acre per annum; while an annual dressing of 2 cwt. of nitrate per acre has produced a total increase in five years of 22¾ tons per acre, averaging about 4½ tons per acre per annum. The increase of the nitrate to 4 cwt. per acre has been of no use, the crop grown on this plot having averaged nearly 1 ton per acre per annum less than that obtained when 2 cwt. of nitrate per acre was applied.

It may be observed that the green fodder was in all cases cut at the same time and under the same conditions on all the plots, and that it was weighed immediately on the spot without being carted. No determinations, however, of dry matter have been

made in the crops, and no determinations of relative digestibility or feeding value. But whatever variations there may have been in the composition of the crops would probably have been found on analysis to be in favour of the more heavily yielding plots,

TABLE II.—LUCERNE, 1897-1901.

Year.	Rainfall.	Plot X (phosphates and potash only).		Plot A (phosphates, potash, and 1 cwt. nitrate of soda per acre).		Plot B (phosphates, potash, and 2 cwt. nitrate of soda per acre).		Plot D (phosphates, potash, and 4 cwt. nitrate of soda per acre).	
		Weight per acre of green fodder as cut.							
	in	tons	cwt.	tons	cwt	tons	cwt.	tons	cwt.
1897.									
1st cutting		1	5½	1	1	1	8½	1	3½
2nd "		1	15½	1	18	2	1½	2	13½
Total	(23·05)	3	1	2	19	3	10	3	17
1898.									
1st cutting		6	11	7	11	7	16½	7	13
2nd "		3	11½	4	1½	4	13½	3	17
3rd "		1	13½	1	18½	2	4	1	14
Total	(18·25)	11	16	13	11	14	14	13	4
1899.									
1st cutting		6	16	8	18½	9	16½	8	18½
2nd "		3	15	5	9	5	16½	4	8
3rd "		2	1	2	18	3	2	2	6½
4th "		2	2	2	9½	2	10	2	3
Total	(24·64)	14	14	19	15	21	5	17	16
1900.									
1st cutting		6	5	8	10	9	15	10	9
2nd "		3	6	4	10	4	17	4	5
3rd "		2	0	2	9	2	11	2	9
Total	(26·60)	11	11	15	9	17	3	17	3
1901.									
1st cutting		7	7½	8	17½	11	1½	11	13
2nd "		3	17	5	2½	6	4	5	9
3rd "		2	15	3	10	3	17	3	5
4th "		1	14½	1	13	1	17½	1	15
Total	(20·26)	15	14	19	3	23	0	22	2

the produce of which was more succulent and less stalky, and probably more digestible, than in the case of the smaller crops. It may be taken, however, that any differences there might have been in chemical composition would be practically of small

consequence compared with the largely increased bulk. For practical purposes I assumed in my former article dealing with the experiments in an earlier stage, that freshly cut lucerne

TABLE III.—LUCERNE, 1897-1901.

Plot.	Manure per acre.	1897 (2 cuttings).	1898 (3 cuttings)	1899 (4 cuttings).	1900 (3 cuttings).	1901 (4 cuttings).	Total 5 years.	Yearly average.
		Weight per acre of green fodder as cut.						
		T. cwt.	T. cwt.	T. cwt.	T. cwt.	T. cwt.	T. cwt.	T. cwt.
X	Phosphates and potash only	3 1	11 16	14 14	11 11	15 14	56 16	11 7
A	Phosphates, potash, and 1 cwt. nitrate of soda	2 19	13 11	19 15	15 9	19 3	70 17	14 3
B	Phosphates, potash, and 2 cwt nitrate of soda	3 10	14 14	21 5	17 3	23 0	79 12	15 18
D	Phosphates, potash, and 4 cwt. nitrate of soda	3 17	13 4	17 16	17 3	22 2	74 2	14 16
		inches.	inches.	inches.	inches.	inches.		
Rainfall		23·05	18·25	24·64	26·60	20·26		

would scarcely be valued by a farmer at less than 10s. per ton, and I see no reason to alter this estimate. Nitrate of soda fluctuates somewhat in price. At the moment it is, I believe,

TABLE IV.—LUCERNE, 1897-1901.

Plot.	Manure per acre.	Gain per acre of green fodder attributable to the use of nitrate of soda.						
		1897.	1898.	1899.	1900.	1901.	Total gain in 5 years.	Yearly average.
		T. cwt.	T. cwt.	T. cwt.	T. cwt	T. cwt.	T. cwt.	T. cwt.
A	Phosphates, potash, and 1 cwt. nitrate of soda	(slight loss)	1 15	5 1	3 18	3 9	14 1	2 17
B	Phosphates, potash, and 2 cwt. nitrate of soda	0 9	2 18	6 11	5 12	7 6	22 16	4 11
D	Phosphates, potash, and 4 cwt. nitrate of soda	0 16	1 8	3 2	5 12	6 8	17 6	3 9

about £10, 10s. per ton, but during the course of the experiments it has been as low as £8, 10s. For rough comparative purposes we may value it throughout the experiments at £10 per ton. We then get the following figures (Table V.):—

TABLE V.—LUCERNE, HADLOW, 1897-1901.

Plot.	Manure per acre per annum.	Total yield per acre in 5 years.		Total increase per acre in 5 years.		Total value of 5 years' increase per acre at 10s. per ton.			Total cost of nitrate of soda in 5 years.			Total profit per acre due to the use of nitrate of soda in 5 years.		
		T.	cwt.	T.	cwt.	£	s.	d.	£	s.	d.	£	s	d.
X	Phosphates and potash only	56	16											
A	Phosphates, potash, and 1 cwt. nitrate of soda	70	17	14	1	7	0	6	2	10	0	4	10	6
B	Phosphates, potash, and 2 cwt. nitrate of soda	79	12	22	16	11	8	0	5	0	0	6	8	0
D	Phosphates, potash, and 4 cwt. nitrate of soda	74	2	17	6	8	13	0	10	0	0	a loss.		

The use, therefore, of moderate quantities of nitrate of soda has been decidedly remunerative. The experiment is being continued.

It is right to point out that the crop is kept clean, so that the fodder weighed is lucerne, and lucerne only, no adventitious weeds or grasses being allowed to grow. Such a condition is necessary in order that the question under investigation may be left uncomplicated by the presence of secondary herbage. At the same time, it must be recollected that the effect which might be produced by manures on the natural competition with the lucerne of weeds and grasses under conditions in which the crop could not be weeded, is necessarily left out of account.

We have also evidence from the Woburn field experiments that lucerne is capable of being remuneratively affected both by sulphate of ammonia and by nitrate of soda. The experiments at Woburn have been in progress for many years, although, it is true, on a smaller scale than our own. Seven small plots were sown with lucerne by Dr Voelcker in Stackyard field in 1889. The plant has since persisted without resowing. Various manures were applied, but, curiously enough, for the first seven years no effect was produced, although three or four cuttings were obtained every year, so that the crop was all the time growing luxuriantly. The land at Woburn has, however, towards other crops, shown itself to be naturally far more productive than would be imagined from an inspection of the soil.

In 1896, however, a marked change was shown, and in 1897 and 1898 the differences caused by manuring assumed large proportions. The crops obtained on the different plots were

recorded by Dr Voelcker in the Journal of the Royal Agricultural Society of England for December 1899, and I may here quote the results (Table VI.):—

TABLE VI.—LUCERNE, STACKYARD FIELD, WOBURN.

Plot.	Annual manuring per acre.	Weight of green fodder per acre.			
		1897.		1898.	
		tons	cwt.	tons	cwt.
1	No manure	14	19	8	17
2	4 cwt. superphosphate, 4 cwt. bone-dust .	15	19	8	9
3	4 cwt. sulphate of potash	17	5	12	2
4	2 cwt. sulphate of ammonia . . .	12	2	8	0
5	2 cwt. nitrate of soda	17	3	11	1
6	Superphosphate, bone - dust, sulphate of potash, and 2 cwt. sulphate of ammonia	22	1	16	11
7	Superphosphate, bone - dust, sulphate of potash, and 2 cwt. nitrate of soda . .	23	18	16	7

The bad effect of sulphate of ammonia used alone, on plot 4, is probably due to the scarcity of lime in the soil, which is unsuitable for the continuous use of this fertiliser unless lime be occasionally applied, either as lime or in some such form as basic slag or bone-meal. In conjunction, however, with bone-dust, superphosphate, and sulphate of potash, sulphate of ammonia has produced a substantial increase. Nitrate of soda, even without the use of mineral fertilisers, has produced a very remunerative return in these two years, but it has done far better in conjunction with mineral fertilisers.

I may say that the history of these plots since 1898 has still further confirmed the practical value of nitrate in augmenting the crop.

Green Peas and French Beans.

It may be interesting, while on the subject, to take the opportunity of recording some experiments which I have made, with the assistance of my friend Mr Shrivell, on the same field during the last two years, on the effect of nitrogenous manuring on two other very important leguminous crops—namely, garden peas and dwarf French beans.

In both cases the ground was dunged with 25 loads (about 12½ tons) of town dung per acre. In each case phosphates were applied, 10 cwt. of basic slag per acre in 1900 and 6 cwt. of superphosphate per acre in 1901. Sulphate of potash at the rate of 1 cwt. per acre was also applied to each plot.

In each case there were two plots, one of which received only the dung, phosphates, and potash as just described, while the other received 2 cwt. of nitrate of soda per acre in addition.

The pea-pods were picked at the time that they were in the best condition for market, the "ready" pods being taken off daily and weighed directly they were gathered. The haulm or straw was pulled, and weighed on the same day, after the crop was completely picked.

The results were as follows (Table VII.) :—

TABLE VII.—PEAS (SHARPE'S "VICTOR").

Annual manuring per acre.	Weight (calculated per acre) of green peas in pod as picked for market.		Weight of haulm per acre.	
	1900.	1901.	1900.	1901.
	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Dung, phosphates, and potash, without nitrate of soda .	2 16	1 3¼	2 17	1 1
Dung, phosphates, potash, and 2 cwt. nitrate of soda .	2 14	1 7¾	2 13	1 3½

No advantage, therefore, was derived from the use of the nitrate in 1900, but in 1901 the crop manured with nitrate of soda was considerably the larger of the two, both as regards the weight of the crop and as regards the development of haulm or straw.

With dwarf French beans the results were far more striking. The nitrogenous manure proved to be extraordinarily profitable. The mode of manuring was precisely the same as in the case of the peas, and the results were as follows (Table VIII.) :—

TABLE VIII.—DWARF FRENCH BEANS.

Annual manuring per acre.	Weight (calculated per acre) of green beans as picked for market.		Weight of haulm per acre.	
	1900.	1901.	1900.	1901.
	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Dung, phosphates, and potash, without nitrate of soda .	2 13	2 17¼	1 8	1 7¼
Dung, phosphates, potash, and 2 cwt. nitrate of soda	4 6	3 15¼	2 5	1 18

In these experiments all the beans were picked as they became ready, in as nearly as possible the same condition of maturity. The difference in crop was not in any way due to a greater degree of ripeness in the heavier crops. In fact, the nitrate seemed in this case to tend to postpone ripening, giving each pod a somewhat longer period of active growth. The nitrated plot yielded very much larger pods, but not in any sense at the expense of tenderness or succulence. On the contrary, in the case of the beans picked from the nitrated plot the culinary quality was in both years, throughout the duration of the picking, better than that of the beans which received no nitrate.

Here, then, we appear to have another leguminous crop, and one of great importance to market-gardeners, which, even when dung is used, seems to be very grateful for a supply of readily available nitrogenous manure.

FARMING IN ABERDEENSHIRE—ANCIENT AND MODERN.

By JAMES WILSON, M.A., B.Sc., Fordyce Lecturer in Agriculture, Aberdeen University.

A HUNDRED AND FORTY YEARS AGO.

It may be doubted whether another county in Scotland has had more written about its agriculture than Aberdeenshire. It might readily be imagined, therefore, that any addition to our knowledge of its agriculture in the middle of last century is a matter of great improbability. But the recent discovery in the library of King's College in Old Aberdeen of the minute book of "The Farming Club at Gordon's Mill" puts in our hands a contemporary record of the state of affairs forty years before Dr James Anderson's 'General View of the Agriculture of the County of Aberdeen' was published. From this volume we shall extract such items as seem best suited to exhibit not only the character and aims of the farming club at Gordon's Mill, but also the condition of Aberdeenshire agriculture a hundred and forty years ago.

The meeting-place was at the Inn at Gordon's Mill, a small village on the banks of the Don, not half a mile above Old Aberdeen. The first meeting took place on the 14th December 1758; the minutes end at January 31, 1765. In the minutes

of the second meeting we find the purpose of the club expressed as follows: "The meeting recommended to the members to have their thoughts upon questions in farming that may furnish proper subject for conversation and to propose them at next sederunt; and were of opinion that such questions may either regard some particular difficulty or matter of doubt which may occur to any member in his own practice, as to which the meeting propose from time to time to give their best advice; or any more general head tending to further improvement in agriculture or the correcting what may appear erroneous in the present system of farming in this neighbourhood. It is appointed that these questions, and such as may be proposed from time to time, shall be inserted in a part of the minute book reserved for that purpose, that they may be taken under consideration as the meeting shall find proper, and that proper experiments tending to throw light upon them may be entered upon by any of the members who shall incline to take this trouble."

The general procedure at the club's meetings may be gathered from the following quotations from their rules:—

"The club shall meet upon Thursday once a fortnight, unless otherwise adjourned, in the room appointed for that end, at two o'clock in the afternoon; against which hour a plain dinner of two dishes of meat shall be upon table. The club shall break up at six in the evening; and the whole expence (including eight pence each, at which dinner is served, also the drink) shall not exceed eighteen pence each.

"Any member of the farming club in New Aberdeen, or any gentleman introduced by a member, shall be admitted and pay his share of the reckoning with others. But the constituent members shall pay for dinner whether present or not, and for this purpose shall lodge from time to time in the hands of the secretary the sum of four shillings as his quota for six dinners.

"No gentleman shall be admitted as a constituent member but by the unanimous suffrage of the whole members present: also the number of the constituent members shall not exceed fifteen, unless upon some very cogent reasons."

Among the early members of the club—they were apparently also the most active—were Mr George Middleton of Seaton, Principal Chalmers (King's College, 1746-1800), Mr Moir of Scotstoun, Professor John Gregory (Medicine, King's College, 1755-64), Professor Roderick M'Leod (Regent, King's College, 1748; Sub-Principal, 1764-1800; Principal, 1800-15), Professor George Gordon (Oriental Languages, King's College, 1730-67), Professor Thomas Gordon, who was the secretary of the club (Humanity, King's College, 1739-65), Mr Douglas of Fechil, Mr William Mossman, Mr Patrick Barron, and Sir Arthur Forbes.

Among other members who joined later, and some of whom seem to have been present at one or only a very few meetings, were Mr Fraser of Fraserfield, Mr Gordon of Craig, Lord Adam Gordon, Lord Errol, Mr Udny of Udny, Mr Robert Arbuthnott, Mr John Burnet of Dens, and Mr Fraser of Auchmacoy. And among the gentlemen who, although not members, appear in the minutes as visitors, was Sir Archibald Grant, the "improving" laird of Monymusk and author of a pamphlet of 94 pages published in Aberdeen in 1760, and entitled 'A Dissertation on the Chief Obstacles to the Improvement of Land, and introducing better Methods of Agriculture throughout Scotland.' He was a member of "the Farming Club in New Aberdeen."

At the present day it is not certain that the sayings and doings of a farming club made up so largely of university professors would command much respect; but it should be remembered that things were very different a century and a half ago, and that most of the professors in this club, if not every one of them, were probably landowners.

The club set itself the task of considering how the agriculture of the county could be improved, and, with this in view, the members gave in descriptions of such systems and methods in farming as they thought would be useful either as examples that ought to be improved upon or that ought to be more generally followed. The three examples relating to dairying, for instance, will be taken by nobody as characteristic of Aberdeenshire a century and a half ago: they will rather be taken as examples that were in those days extraordinary, and the last of the three might even be set up as a pattern for many a dairy at the present day.

In order to make some of the extracts more readily intelligible the following diagram (fig. 5) is designed to show the main divisions of an Aberdeenshire farm in the middle of the eighteenth century. This diagram is of course nothing more than a diagram, and makes no pretension to being an accurate representation of any particular farm. It is based upon the description given by Dr James Anderson in his "General View," drawn up for the Board of Agriculture and published in 1794.

The arable portion of a farm was then divided into two main divisions, the *infield* and the *outfield*. The Infield is represented by the innermost of the three circles. It usually extended to a fifth of the whole arable land, was nearest the farm-steading, received all the farmyard manure, and was continually under crop. The rotation was bere, oats, oats; bere, oats, oats; and so on continuously—a kind of three-course rotation: the manure being applied to the bere crop.

The Outfield was divided into two unequal portions, the *folds* and the *faughs*. The Folds, which extended to about one third

of the whole outfield, were usually divided into about ten portions. One portion was broken up from grass every year. This portion "is surrounded with a wall of sod the last year it is to remain in grass, which forms a temporary enclosure that is employed as a pen for confining the cattle during the night time and for two or three hours each day at noon. It thus gets a tolerably full dunging, after which it is ploughed up for oats during the winter. In the same manner it is ploughed suc-

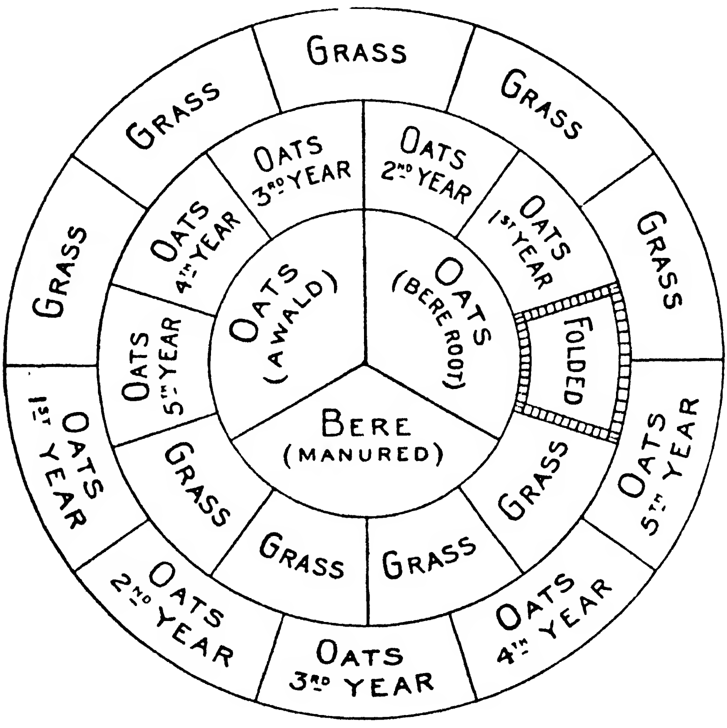

Fig. 5.—*Divisions of an Aberdeenshire farm in the middle of the eighteenth century.*

Outer circle—Faughs; middle circle—Folds; inner circle—Intown.

cessively for oats for four or five years, or as long as it will carry a crop worth reaping. It is then abandoned for five or six years, during which time it gets by degrees a sward of grass, when it is again subjected to the same rotation. The Faughs never receive manure of any sort; and they are cropped exactly in the same manner as the folds, with this difference, that instead of being folded upon they are broke up from grass by what is called a *rib-ploughing* about midsummer, one part of

the sward being turned by the plough upon the surface of an equal portion of ground that is not raised, so as to be covered by the furrow. . . . It is allowed to ly in this state till autumn, when it is all ploughed over, as it can be done, and is sown with oats in spring. It produces a poor crop, and three or four succeeding crops still poorer and poorer, till at last they are forced to abandon it by the plough, after it will scarcely return the seed."

On some farms there were two other kinds of land—viz., the *laigh lands* and the *burnt* or *brunt lands.* "The Laigh Lands are a kind of low lying moist meadow ground, sometimes with a mixture of moss. They are invariably ploughed three years for oats on one furrow, and are allowed to be in grass for three years, and so on alternately, without ever receiving any dung. Brunt Lands are now very generally managed after the same manner. They are always of a mossy nature. The turf, when broke up from grass, used to be gathered into heaps and burnt, and immediately sown with bear, after which two crops of oats were taken in succession, and then it was suffered to run to grass. But this practice of burning having been found prejudicial, is now very generally prohibited, so that the practice is now rare, though the patches that had been formerly subjected to it still retain that name."

An Ythanside Farm.

[*4th Jan.* 1759.]—Mr Douglas gave in to the meeting a report of the state of a farm on Ythan side of such a middling sort as to give a just idea of the run of them in that neighbourhood, with his observations upon the faults of the management, which the meeting appointed to be inserted in their book. It is as follows:—

"The farms on Ythan side are some of them large, others middling, and some smaller; what follows regards one of the second sort, neither the dearest nor cheapest of its kind.

"The rent of the above farm is £266, 13s. 4d., at £5 per boll.[1]

		Bolls.
The tacksman commonly sows . . .		68
Intown and crofts . .	30	
Folds	20	68
One fur ley[2]	6	
Faughs	12	

"This farmer employs 3 men and a boy in summer, 3 men in winter and keeps 12 oxen, 6 horses, 3 cows, 6 or 8 yield cattle[3] and about 60 sheep.

[1] Scots money. Divide by 20 to bring it to money sterling.
[2] See "laigh lands," above.
[3] Apparently young growing cattle.

"His returns will be from $3\frac{1}{2}$ to 4.

"His intown is divided into 3 parts; $\frac{1}{3}$ for bear, $\frac{1}{3}$ called bear-root, and $\frac{1}{3}$ awald.

"The folds into ten parts, of which 5 are constantly under grass and the other 5 under corn. By this means each fold carries five crops, and is tathed[1] every 10th year.

"The one fur-ley,[2] or ground broke up before winter and sown after one furrow the following spring, bears 4 crops of corn and 4 crops of grass alternately.

"The faughs are taken in upon the 5th grass; they get two furrows, and carry 3 bad crops of broked corn.[3]

"When the bear-seed is over, the oxen plough enters to the faugh and the horseman to the casting and leading muck-fail.[4] This last employs the one till peat-leading, at which both assist. When that is over, the oxen return to the faugh and give it a second furrow, while the horseman finishes the middings by the addition of some more fail, with what warm dung the stables and byres afford put over it. In this state they lie till after harvest, when they are hacked down with an instrument called the Hack-muck and carried to the land.

"In harvest, all hands but the herdsman go to work with an alacrity, expedition, and chearfulness that would surprise one. This is the only part of country labour in which our people excell. As soon as the bear is carried into the yard, the oxen plough begins the tillage for next crop with the bear-root; then it moves to the low wet lands, and after that to the remaining fields, never ceasing when the weather will permit, whatever state the grounds may be in.

"In spring our farmers sow and harrow as fast as they can, little regarding the season or state of the soil; and when the oat seed is over, they immediately begin to sow their bear, a part of which they had dunged before harvest; the remainder they manage in this manner—either they carry out the bottoms of their fail middings which had got no mixture; or they cast some fresh fail, which they hack and spread on the braes of the riggs, dunging the middle part with raw undigested stuff from their stables and byres."

[1] Manured with dung. [2] See "laigh lands," above.

[3] Broked corn was a mixture of *great* corn and *small* corn. The great corn was the common oat, *Avena sativa;* the small corn, from Dr Anderson's description and from the fact that it is still a prevalent weed in Aberdeenshire and the North-East, was probably *Avena strigosa.* The great oat was sown on the better land, the small oat on the poorer. Sometimes a mixture of the two was sown, in the belief that it would afford "a much more weighty crop, especially of fodder."

[4] See "moss middens."

Farm Account relating to the Ythanside Farm.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To rent	£22	2	2⅜	By 32 bolls bear at 10 sh. . .	£16	0	0
To 3 men and a boy and woman in summer, 3 men and a woman in winter their fees . . .	7	6	8	By 66 bolls intown corn at 8 sh. and 4d.	27	10	0
To 4 hooks in harvest . . .	2	6	8	By 18 bolls one fur ley corn .	7	10	0
To 40 bolls meal at 8/4 . .	16	13	4	By 50 bolls meal from folds .	20	16	8
To 3 bolls bear in malt . .	1	10	0	By 10 ewes and lambs 4/- . .	2	0	0
To difference betwixt 2 old and 2 young oxen	4	0	0	By 2½ stones butter at 8 sh. .	1	0	0
To loss on horses	2	0	0	By 2 four year old steers or quays	4	0	0
To 6 stones iron, 3 sh. . .	0	18	0	By hire of ploughs and leading peats	2	0	0
To 6 firlots meal to the smith .	0	12	6	By 6 bolls faugh corn 4/2 . .	1	5	0
To timber and plough wright .	0	15	0				
To salt, fish, oil, &c. . . .	2	0	0				
To expence of selling and delivering grain	1	0	0				
To canvass, riddles, &c. . .	0	12	6				
To kirk and mercat charge . .	2	0	0				
To ballance for profit and interest of stocking	18	4	9⅝				
	£82	1	8		£82	1	8

"The sheeps wool with house industry will cloath the family; and the wife will spare some sids[1] and cheese and perhaps a calf for defraying incidental charges and schooling one of the children.

"*N.B.*—There is 12 bolls corn allowed for the horses in spring time; before that they get nothing but the refuse of the corns mixed with dust and bear chaff boiled.

Suppletory Account.

8 bolls of bear will return 40, seed deduced remains	bolls	32	0	0
22 bolls corn intown 88, take off 22, remains . . .		66	0	0
6 one fur ley, off 6, remains . . . . . . of this 12 to horses.		18	0	0
20 fold[2] will return 4½ tath and awald, 3½ third and fourth crops, and 3 the 5th. These make 76, off seed remains 56, will turn out 50 bolls meal.				
12 faugh will return 30, of 6 for seeds and 12 for the horses remains		6	0	0
The family 4 men 2 women 3 bairns at 1½ peck per man 1 peck woman and bairns pr week make . .	bolls	35	3	0
The boy 26 weeks at 1 peck		1	2	2
Extraordinary hooks in harvest		2	0	0
		39	1	2

[1] The husks of oats after the meal has been removed.

[2] This means that there are 20 bolls altogether sown on the Folds, and that the portions in oats the first (tath) and second (awald) years will return 4½ fold, the portions in oats the third and fourth years will return 3½ fold, and the portion in oats the fifth year will return 3 fold.

Servants.

1 ploughman	£2 10 0
Another	2 0 0
Goadman	1 10 0
Woman	1 0 0
Herd	0 6 8
	£7 6 8
Hooks 3 women at 11/1⅓	£1 13 4
One man	0 13 4
	£2 6 8

"*N.B.*—The family besides their meal have sids, milk, kail, potatoes, and other stuff from the yard."

Soil-burning in Buchan.

[1*st March* 1759.]—Mr Douglas, Fechil, gave in the report referred to in the minute of last meeting relating to the practice of burning in Buchan, as follows:—

"In New Deer and the neighbouring parishes the tenants formerly burnt their dry faughs, which were ribbed the beginning of summer, the turf set in heaps, kindled, and, when reduced to ashes, spread over the ridges and plowed in for corn, to be sown the following spring; after which three and sometimes four crops are taken. But now that there is plenty of lime in that corner, the practice is disused.

"In the same parishes worn-out mosses are still burnt. Careless, unwise fellows rib as above, never set the turf, but when it is dry kindle it in several places, by which means if the season proves droughty, attended with wind, the fire runs and spreads in such a manner as to reduce the whole soil to a mass of ashes. The consequence of such management is obvious. But the more skilful farmer about the end of May or beginning of June, with his plough lays 4 furrows together in the middle of every ridge, a part of which he sets up, and burns it when dry, carefully covering up the ashes. Before or after harvest, as most convenient, he plows the ley part of the ridges, and the following spring spreads the ashes and harrows them in with grain.

"Where their burnt-lands, as they call them, are deep moss, they take the opportunity of a dry summer, and kindle them in sundry places. When they think there are ashes enough they put out the fire, if they can; but often they cannot. The following spring these ashes are partly spread on the moss itself,

which is either ploughed or dug before that time. The remainder is carried as manure to the other grounds in the neighbourhood. Bear is sown and plentiful crops obtained."

Report by Mr Cumming of Achry.

[*25th March* 1759.]—"Mr Cumming concludes his report with the following account of the progress and improvement of husbandry in his neighbourhood: That before the year 1750, the chief methods used for producing corn with them was (abstracting from tathing, dunghills, and faughing) by burning leys, moss, and draining laighs of a mossey quality and burning them also. In summer 1750 he observed all the country in a smoke, and concluded that the mosses would be exhausted, although they had great plenty, and their leyes would be reduced to a *caput mortuum*, unless the custom of burning was stopped. But then some other method of producing corns was necessary, otherways the farmers could not live. He also observed how little value they put upon labour, and how idle their horses and oxen were all summer. He attempted to get them to carry lime on their horses back to supply for the stop of burning, the roads being in such disrepair as not to permit carts. Upon tryal and setting them an example, by buying a set of old horses of a small size, he found it would not answer on horses backs. Then he got the roads repaired and bought horses rather worse than the farmers used, and procured carts such as they could easily furnish. With these he brought lime stone and burnt it at home. This hit their taste, as the stone was cheap, firing easie to be had, and their labour of breaking and burning of little value in their eyes. Then he got oxen wains;[1] some followed that example; but with horses, there is scarcely one, who has 10 or 20£ worth of croft land and a horse, who does not bring more lime or limestone than he is bound to do by tack. This indeed required the making an example of one or two that were deficient and fineing them in a small thing. This method, with what command they have of water, has made a great alteration upon their corns and circumstances to the better.

"He also keeps meeting with his own farmers, entertains them with a glass the produce of the country in a publick house. All who do not improve are debarred, and go by the names of *Drones*. There is a book kept of all improvements worth while, particularly what lime or limestone each has carried, and they are commended accordingly. This excites emulation."

[1] Waggons.

Moss Middens.

[15*th March* 1759.]—"Mr Gordon, Humanist, also reported that in obedience to the directions of last meeting he had enquired into the method of preparing dunghills principally of moss, and had found Mr William Sympson, who has the merit of the invention, very communicative and obliging on the subject. The account he made of his practise was this—His first method was to lay 3 feet deep of rotten moss in the bottom; then a stratum of lime 6 inches deep; above the lime from 2 to 2½ feet deep more of the moss; then another stratum of lime, with moss above it, near 2 feet deep and above all a cover of dung, and sometimes dung interjected. This method he found both troublesome and inconvenient.

"He now collects such a quantity of rotten moss as he thinks necessary, which he raises 4 feet high, then a stratum of rank horse dung for keeping up the horse feet; above this 3 feet deep more of rotten moss, with a cover of dung above all. As soon as he can get as much more dung as is necessary for raising the compost to a proper fermentation, he causes drive the dung to the sides of the midding and at the same time brings out as much lime as will serve the men to mix into the compost in a days time. The lime is laid at each end of the trench which is thrown in with spades at that part of the trenched moss. The lime moss and dung, being well mixed with a common hack-muck, is thrown by to make room for more to be mixed in the same manner.

"He has commonly 4 or 5 men at the trenching and mixing, when they find dung is wanted. What is laid at the sides of the dung-hill is a constant supply, being thrown into the trench with the grapes, and the lime with spades or a box barrow. The lime getts a thin cover of moss thrown upon it to preserve it from rain or wind. So they continue trenching and mixing, untill that part of the compost which is trenched is become 5 feet high. When it is advanced so far, it is spread on the top, and one of the men continues on the top to raise it higher, by throwing from the fore part of the trenched compost what is thrown up to him by those below, and so continues untill it is raised about ten feet high, some times less and some times more. When higher there is occasion for two shelves. . . .

"The higher and greater the dunghill is made, so much the better for raising fermentation. When finished it commonly lyes 3 months, some times more, before it is laid open in order to be carried out upon the ground. In that time if well mixed with dung and lime, it will smoke in the middle, so as to be observed at a considerable distance. When the fermentation is brought

so high, it has great and quick effects, being much better than horse or cow dung without mixture.

"In the first way, the lime did not mix so well; as the rain and dampness of the moss earth made it stick together, and some parts of it had either too much or too little, sometimes of lime, sometimes of dung. The last way has both at command; and the lime mixes much better when dry. Upon the whole, the success of this compost depends on taking nothing but rotten moss, and in thoroughly mixing it with the lime and dung so as to raise it to a proper fermentation.

"Mr Sympson keeps no account of the proportion of the rotten moss to the lime or dung. He commonly inspects the men twice a day in trenching and orders such a quantity of lime or dung to be put in as he judges it will require. His men are now so much in the practice that they can do it without inspection. But one cannot well overdoe, as the richer it is made, it raises the fermentation so much the higher and consequently can be thinner spread, as the less quantity serves. At first he used to give only about 8 bolls lime to the acre and about 5 times as much bulk of the moss as of dung and lime. But he now gives double that quantity of lime and the same quantity of dung as formerly; being much the same expence in trenching and at the same time has a greater and more durable effect, and answers the additional charge of the lime.

"All hot dung is best for mixing with the rotten moss, although he is obliged to mix some cow dung.

"The ground which lyes nearest his moss, on which he lays this compost, is a dry thin sandy or gravell soil."

Errors and Neglects of the Common Farmers.

[Report by a committee of the club, 17th March 1760.]

1. The want of enclosures.
2. The not winter herding, which prevents winter haining.
3. Bad and Unseasonable Ploughing.
4. The not changing their seed corn.
5. The depending too much on grain crops, and their ignorance of many ways in which a part of that grain might be expended when the prices are low.
6. The total neglect of that part of their ground called faughs.
7. Too great a number of horses and other cattle which occasion the further expence of too many servants. As these cattle are ill fed in summer the quantity of dung they throw must be small; nor are they able without being stressed to perform the work that fewer well fed cattle can do with ease; besides, after a dry season, when the straw crop is scanty, the tenant, barely

to keep in their lives, is often obliged to lay out so much money for corn and fodder that he loses more in one year than he can recover in several.

8. The great scarcity of grass. The common tenant takes every way to scrimp himself in this article; he throws up his best swards for muck fail, he plows too far and he over crops. From the two first errors there doth not remain ground enough for pasture; and by over croping, what is left is in so poor a state that little grass can be expected from it.

9. The universal bad practice of working their oxen untill they are old; for then the best feeding will not make good beef of them.

10. The infrugal way they take to replace the cattle that are past their labour.

11. The want of knowledge in the easie art of stall-feeding with turnips and potatoes.

12. The want of good bulls and the small breed of cows; these give little milk and that milk is very ill managed; for they do not know how to make good butter, and they less know how to make good cheese; nor are they skilfull in fatning calves for the knife or rearing them for work. Out of three meagre creatures designed for the butcher two may be reared for the plough and the remaining one, full fed, will be worth more than three starved ones.

13. Their ignorance in the sheep article. The common kinds are too small. They are starved in summer and almost quite neglected in winter. They yield very little wool, and even that little is spoiled by the nasty places they are kept in; the ewes are many of them either barren or miscarry from bad usage; and these that bring furth lambs have not milk enough to fatten them.

14. The preposterous method they follow in gathering and making up their dung-hills; the injudicious way they use them. For a certain quantity of land must be dunged from the proposed dung-hill, without any regard had either to its bulk or quality.

15. Their imprudence in declining long tacks; and their binding themselves to carriages and other servitudes rather than pay a money pittance in lieu of them.

Cheese as made at Lesmoir.

[1st *March* 1759.]—Sir Alexander Gordon laid before the meeting the practise of making butter and cheese as carried on in his family, which the meeting appointed to be inserted in the book as follows:—

"Keep the evenings milk with the cream in a clean vessel,

and before you milk the cows in the morning, put water on the fire to boil. Take the warm milk from the cows and mix with the evenings milk. Put in as much boiling water as will make it warm enough to receive the runnet, then cover it with a clean cloth till the whey come above the curd. Press out the whey very gently, and lifting the curd as whole as possible, put in a clean cloath in the chessel[1] and another between your hands and the curd, and press softly down untill the chessel be quite full. Afterwards put a flat stone over the cloath which covered the mouth of the chessel, with a weight on it of about 16 or 20 pounds, which must remain about three hours, and then put on more weights by degrees. Before night give it other two clean cloaths to suck out the whey; and in the morning take it out of the chessel and rub it well with salt and at night turn it. Next morning put it on a clean board, and every day turn it, putting it on a dry part of the board. Let it dry at leisure and every morning rub it with a hard cloath, which lets out the whey and makes the skin thin, so as to have the smoothness of Glouster cheese."

"*N.B.*—It is imagined that putting in the boiling water disolves the oily particles of the milk by separating them from the whey, which makes the cheese the fatter, as the whey is observed to be much thinner than that from cheese made in the usual manner. The not breaking of the curd much and straining out the whey by putting on weights by degrees is likewise thought of use, as by breaking the curd and pressing it much the oily part of the milk would escape with the whey."

To make Butter [*Lesmoir*].

"Keep the cream from one to three days before you churn. Warm the barrel, which must be perfectly sweet, with warm water: then strain the cream through a clean cloath into the barrel, moving the handle which turns it with an equal motion. When the butter is near coming or curdling put in half a mutchkin—or more according to the quantity to be made—of boiling water: then stir again untill the butter be made. Put it into a clean vessel, and with a spoon, without touching it with the hand, take the butter from the milk, and beat out the milk from the butter with a flat mallet: also beat in fine powdered salt more or less, as you design to keep it; if you intend to keep it long put near an ounce to the pound. Do not wash it."

"*N.B.*—It is observed of the common sale butter made by the

[1] Cheese shape.

country people, that on melting it over the fire, there remains a thick curdling milky substance which appears to separate from the more oily part of the butter, which does not happen at leaste in such quantity in the butter made as above directed. For it is believed that here likewise the boiling water by disolving more of the oily part of the milk, makes the butter the richer by almost wholly separating it from the butter milk, which by the above mentioned sediment, ocassioned as is supposed partly for the want of the boiling water and partly by washing it without throughly beating out the butter milk, is amongst other things faults in the common sale country butter."

To make good Butter.

[14*th June* 1759.]—The following paper relating to the making of butter was given in from a family that are distinguished for their excellency in that article:—

"To make good butter skim the milk before it be the least sour. Keep the cream in a well glased earthen pot; and if convenient churn it every two days by a regular even motion, not too quick. When the butter is come, pour the milk carefully from it, and with a wooden spoon or laddle work or press the milk clean from the butter in a wooden bowl, which must be throughly scalded a little before it is used and then left standing full of cold water untill quite cold. This last prevents the butter from sticking to the bowl. Great care should be taken to press the butter from the milk before water touches it, which makes it close and firm, whereas if the water is poured on with any milk remaining it is apt to make it fozy. Then wash it in plenty of spring water till the water comes off clear as when put on, which the second water will do if the milk is rightly taken from it. Work it throughly in each water with the back of the ladle, pressing it well; then work it from the water with as much care as from the milk, pressing always as worked, which by experience is found preferable to beating as much as a ladle or spoon is to the hand; but if any chuse to use the hand, it ought to be often dipped in water to prevent the butter adhering to the fingers. What is for keeping over year should have six drops of fine salt to sixteen ounces of butter, throughly mixed and worked with the ladle; then instantly press it in the pot or kit. A very close glased pot is found preferable to wood; rub the pot first round with dry salt and then shake it out, and throw a very little dry salt upon the top of every churning to preserve it till the pot is filled, then cover it with a good hand-full of salt, and pour on a strong pickle of cold water and salt.

"Everything relating to milk or butter should be most ex-

actly cleaned; for if a skimming drain or seymilk[1] or even a spoon that is not well scalded or boiled touch any part, it will spoil the whole; for this reason the milking handy,[2] pales, &c., as well as cogs[3] are every male[4] first cleaned from milk with cold water, then scoured with sand and after boiled in a large copper of clean water. If the milk chance to sour in the cogs, they will require two boilings to make them fit to receive milk again. A few minutes boiling will do. Where the convenience of a copper or kettle to boil the milk-vessels is wanting, the next best is to fill them with boiling water when clean and putting a red hot brick in them.

"Skimming the milk before it turns makes the finest butter, and churning the cream after gives a larger return of butter than when it is kept. The cream pot must be well cleaned and boiled every time you churn. You should have two cream pots, one to sweeten and cool while the other is in use."

Improvement of Agricultural Practice.

Having informed themselves as to the defects of the agriculture of the county, the members of the Gordon's Mill Club then set themselves to learn and to devise methods to secure their remedy. Their energies were directed in two or three main directions. In the first place, by correspondence with agriculturists at a distance and by the observations of members of the club or of their friends who happened to travel in other parts of the country or abroad, they contrived to learn of other methods or of improvements which might be applicable to their own district. The information collected by the club in this way came very largely from the Lothians and from Norfolk.

In the second place, they endeavoured to discover the weak spots of the local methods, and, by suggesting the elimination of these, arrive at an improved agriculture. They also started with the intention of making experiments play a considerable part in their work, and a considerable number of experiments were suggested; but whether it was that their ideas in regard to original experiments were expelled by the vaster ideas flowing in from the South or that procrastination or forgetfulness or something else did its work, their experiments came to very little. Experiments were carried out in distilling from potatoes, in feeding bullocks with turnips, and in manuring with lintseed dust, but they came to little—so it seems, at anyrate, to us to-day.

[1] Milk-sieve.

[2] A wooden milking-pail with one (or more) of the staves left longer than the rest so as to form a handle.

[3] Other wooden milk-dishes.

[4] Probably every time. Modern German = *Mal.*

The discussions on local methods relate to such subjects as the following: the relative cost of ploughing by horses and oxen; improved implements, especially ploughs and waggons; liming; the management of middens; winter herding of stock; the saving of clover and other seeds usually got from England or imported, and which might be grown at home; the inclosing of ground; leases; sowing grasses and clovers on the infield; manuring the faughs; book-keeping for farmers; the management of sheep; and suchlike. They were in communication with some gentlemen in Banffshire and with others in Edinburgh about a society to be formed which was to give premiums for the encouragement of arts and agriculture; they suggested to the Town Council of Aberdeen that a flour miller should be brought from England in order to improve the flour from home-grown wheat.

They also seem to have moved successfully in getting the Town Council to resolve to establish a corn market in Aberdeen: "6 October 1760.—The council agrees that the Chappel at the Castle-hill be fitted up for a Corn Mercat for a year, and a proper road from the back of the Castle-street be made out thereto." This order was not, however, carried out at the time intended, because of a difficulty in connection with the collection of the town dues.

Jethro Tull's Theories.

But the chief factors in determining the nature of their discussions and the influence they were to have on the agriculture of the county were Jethro Tull's theories and the method of agriculture pursued at the time in Norfolk. Jethro Tull published his book on 'The Horse-hoeing Husbandry' in 1733, and a short quotation will show his main principles: "Tillage and tillage alone will supply the food of plants, and will, in most cases, render manure wholly unnecessary. By dung we are limited to the quantity of it we can secure, which, in most cases, is too scanty. But by tillage we can enlarge our fields of subterranean pasture without limitation, though the external source of it is confined within narrow bounds. Tillage may extend the earth's superficies in proportion to the division of its parts, and, as division is infinite, so may the superficies be."

Such ideas naturally caught the imagination of the Aberdeenshire men as it had caught others in the South, and they did not stop at discussing but proceeded to make actual trials of the new method of culture.

In June 1761 a paper was read on the horse-hoeing trials by Mr Gordon, the secretary, and we find it stated by him that "trials in the new husbandry have been made this season by Mr Middleton, Sir Alexr. Gordon, and the minister of Kintoir;

of whose progress some account is now to be given: also by Sir Archibald Grant, Sir Arthur Forbes, and Mr Fordice at Eggie, of whose experiments proper information is not yet obtained." Other papers and reports follow, but all go to show that culture "in the horse-hoeing way" was not an unqualified success. Where the ground was good and in good heart, the horse-hoeing seemed to have succeeded—for a time at anyrate—but where it was not good, the horse-hoeing was almost an immediate failure. Some of the causes assigned for failure were that "the field was scourged most immoderately by the tenant who left it"; "the greater depth at which the drill plough deposited the seed"; the bringing to the surface of "unfertilised," "unfruitful," and "dead" earth.

Norfolk Husbandry.

Next to Jethro Tull's horse-hoeing husbandry, the thing from a distance that bulked most in the proceedings of the club was the Norfolk Husbandry of the time; and undoubtedly it would have bulked still more largely had the club continued longer in activity. We read of it in the minutes first in 1762, and in the same year there are several exceedingly lucid descriptions of this new husbandry. As the Norfolk "circle of farming"—viz., turnips, barley, clover, and wheat—is the same to-day as it was a hundred and forty years ago, we need not quote any of those descriptions. We shall quote only a few extracts from the minutes to indicate how it began to have effect in the north-east of Scotland.

[28*th October* 1763.]—"Report was made to the meeting that Mr Barclay of Ury was carrying the Norfolk Husbandry into practice with great spirit and success, and that particularly he was using the Norfolk plough, and by means of it putting a great deal of work through hand, only with two horses and one man without any driver. The meeting judging this to be a matter very proper for their attention, recommended to the Secretary to wait upon Ury and go over his farm, in order to observe his method of proceeding and give the meeting an account of the same."

[24*th November* 1763.]—"The Secretary reported that it was not in his power to go to Ury, according to appointment of last meeting, by reason of some particular affairs that detained him; but that he saw the Norfolk plough at work at Monymusk, and was promised an exact admeasurement of that machine and should report the same to the meeting." [The club seems to have taken some time to determine whether it was the Norfolk plough or the Norfolk rotation that was effective.]

[15*th December* 1763.]—At this meeting Mr Barclay of Ury

was present. "In our way of ploughing the roots of the grass were greatly encouraged, and actually took a great growth, so as to hurt the crop. Mr Barclay deduced an instance that fell within his own observation. A field of his was divided between him and a tenant, both shares being in equal heart, and every way equal as far as could be perceived. Mr Barclay plowed in the Norfolk way, and the tenant in the common way. The consequence was that Mr Barclay's crop beat that of the tenant out of sight, which could be imputed to nothing but the method of plowing, as everything else was alike. It should seem, however, that when ground is laid up for the winter, the rougher it is done and the more of the mould is exposed to the frost and air so much the better.

"Mr Barclay mentioned that he managed more than 60 acres or bolls sowing with the plough and four horses upon the Norfolk plan, besides the work at bringing in ground to this culture, which could not be so well estimated; but that the number of acres turned over in a season in managing even that extent of land in the Norfolk way will upon computation appear a very considerable sum. His servant is from Norfolk, and stands him only £12 per annum for wages and appears to be fully bred. He sent some of our country servants to Dalkeith to be bred under Mr Townsend's people, who were very obliging and readie to show them everything; but found it did not answer.

"Mr Barclay differed from the memorial[1] as to their giving over in Norfolk the feeding their turnips in the ground. He mentioned his own practice of sowing the turnips immediately as he takes the plough out of the ground; and that after taking up a yoaking he does not allow the servants return home till they have sowed what was ploughed at that time. He shewed the make of his hurdles or flakes, which are but slightly made up of the wood readiest at hand. Each cross bar is about 4 inches thick, the two side posts 4 feet 9 inches high, and the middle one 4½ feet. The ordinary length of one of those hurdles is 7 feet, including the posts or upright pillars. These are set up breading the field, or across the field breadthways from wall to wall, and every day shifts them a little forward to give the sheep and cattle a new provision. In setting the flakes, it is proper to notice that the cattle may have some place where they may lie dry. If this cannot be had, the turnips are pulled and carried to the nearest field which he proposes to dung and where they can lie dry. This feeding in the field undoubtedly prevents a considerable expence, which will be required to transport turnips to the farm yard. In time of frost a servant

[1] One report on the Norfolk culture said that feeding cattle in the field on turnips was being given up.

with a mallet bruises the largest turnips as they stand in the ground, or with an iron spade gives them a cross cutt, which letts the sheep or cattle get more easily at them. When the turnips are about $\frac{2}{3}$ parts consumed within where the flakes were set, another row is set up behind the feeding cattle and sheep; and the remaining turnips being pulled up are left on the ground to be washed with the first rain, after which the hungry cattle and young store, &c., are turned in who eat up the turnips thus left and washt. The hogs, however, will find provision even after them.

"The feeding turnips on the ground is found to have this additional advantage, that it prevents the rising of spurry (or yar, as we call it) and the skellach and other seed weeds, which are very apt to take place and be very troublesome in ground that is often stirred with the plough."

In addition to these two matters discussed by the club, there were many others of less importance, and we make a few quotations.

VARIOUS.

[26*th January* 1764.]—"The company were assured that in the north of England there was excellent mutton brought to the table of one year old; notwithstanding the common opinion that it was not good till it was five year old."

[26*th April* 1764.]—"The meeting had some conversation concerning feeding up what is called house lamb; and were of opinion that this is a very easie matter, though not attended to anywhere but about London and Bath."

[26*th April* 1764.]—"After the first fortnight the calves [being fed for veal] should be blooded once; the same after the second fortnight, and afterwards once a week while they are feeding."

[26*th January* 1764.]—"The new proposal of using limestone pounded in a machine instead of being burnt in a limekill was mentioned; and that it was presumed the efficacy of such lime in enriching ground would be equal if not superior to burnt lime; and my Lord Errol acquainted the meeting that he had got some bolls of this pounded lime and was to lay the same on the ground."

[26*th January* 1764.]—"Sowing a little powdered lime over the turnips is the best preservative against the fly."

[29*th March* 1764.]—"Sowing peat ashes over turnips prevented the fly as well as powdered lime."

[*August* 26*th*, 1762.]—"Mr Middleton reported that Aprile was a year he had sown Lusern in drills at four foot distances in the bridgefield in the poorest part of the ground. That it had cut three times last year; that he had already cut it four

times this season, and was sure of a fifth if not of a sixth cutting. That it was very fresh and vigorous even in this very backward season of grass. When cut it was about 15 inches high. The first cutting was a fortnight sooner than any other grass.

"Mr Middleton reports likewise that in some poor exhausted ground in Cotton which had been two years in horse hoing without any crop he hoped some advantage from the fallow and laid it out with the broad drill in bear three pecks of seed to the acre, and with the same broad drill sowed clover four pound to the acre. Whether from the bad season or the poverty of the soil his bear has misgiven; but from the rising of the clover he has reason to expect a very good crop and the ground perfectly well covered with clover. In which event it may be concluded that 12, 15, or 18 pound to an acre is so much superfluous seed. The clover was sown at the same time with the bear from drill boxes.

"The Saintfoin seed comes to very good perfection here. Mr Middleton has sown it of his own raising and finds it does very well."

From the minutes of the club we can put in parallel columns the various rotations then in vogue:—

Norfolk.	East Lothian.	The Carse.	Aberdeen.
Pease or turnips.	Summer fallow, dunged.	Summer fallow and pease.	Bere.
Barley.	Barley.	Wheat.	Oats.
Clover.	Oats.	Barley.	Oats.
Wheat.	Pease.	Oats.	
	Wheat.		

In the beginning of 1762 there were signs of the interest in the proceedings of the club declining, but these seem only to have been temporary. After this time the meetings were held only once a month; but occasional new members joined almost up to the date when the minutes stop—the 31st January 1765. Whether the club then ceased activity or not is not recorded.

A modern Aberdeenshire Farm.

In order that the difference between to-day and a hundred and forty years ago may be more clearly apprehended, it has been thought well to add to the account of agriculture as it was in Aberdeenshire in the middle of the eighteenth century an account of the management of a typical Aberdeenshire farm as it is at the end of the century just closed.

It must be understood at once, however, that the farm to be described is by no means the best, not even one of the best, in Aberdeenshire. It has been chosen because it is a fair sample,

because it is situated in a central district—in the Ythan basin—and because, by reason of the farmer keeping an accurate note-book, some points that are possibly the most interesting can be treated otherwise than at haphazard. And it must also be understood that there is no opinion implied as to the system of management, which is merely that of the district as exemplified in the case of this particular farm. In some matters it will be seen that the farmer, who when he has formed a theory of his own is not afraid to put it to the test, has struck out somewhat from the usual practice—as, for instance, in his treatment of a piece of poor pasture and in his buying so little "artificial" feeding-stuffs. He is of opinion that, while oats are at their present price, it would not pay him to use any other food for his cattle, for he would then have to be at the expense not only of selling oats and buying perhaps dearer substitutes but also of extra cartage and railway carriage. It is also probable that, had the farmer more winter accommodation for cattle, he would not sell any oats, but would even buy extra "artificials," and so, by giving them smaller quantity, feed more cattle than at present upon the same acreage of turnips.

Rotation.

The farm now to be dealt with extends to 254 acres, all arable: 115 being a good loam and the remainder stiff clay. The rent is £210, together with £6 which are paid as interest on drains laid down four years ago. The farm is worked upon the six shift, and the crops are therefore approximately—

42 acres of oats after lea.
42 acres of turnips (27 yellows and 15 swedes).
42 acres of grain after turnips (28 oats and 14 barley).
42 acres of first year's grass (21 hay and 21 pasture).
42 acres of second year's grass (pasture).
42 acres of third year's grass (pasture or, in parts where the grass is failing, ploughed and sown with a mixture of beans, peas, and oats).

Perhaps the clearest way of telling the main field operations is to follow the treatment of a portion of the farm through the six years of the rotation. We shall begin with the breaking up of the lea.

Tilling Lea Land.

The ploughing of the lea is begun about Martinmas, and is finished earlier or later in spring as the weather has allowed. The oat seed is sown near the end of March; and while, with the older varieties, the amount of seed is 6 bushels to the acre, with the newer varieties the farmer prefers to sow 7. Before

the seed is sown the land gets a single turn with the harrows in the direction of the furrows; after the seed is sown it gets two turns in the same direction, two across, and a final turn in the direction of the furrows. That is to say, it is harrowed six times; after which it is rolled—the stones being taken off at the same time—so soon as it is dry enough. The oat crop is harvested about the beginning of September, and the crop amounts to 5 quarters of grain, 41 lb. to the bushel, 4 bushels of light grain, and about 25 cwt. of straw. The stacks are built round, without bosses, and of sizes to contain from 12 to 15 quarters of oats and about 10 of barley—sizes suiting the size of the barn, and apparently also the climate of the district.

Turnip Culture.

When all the grain crop is into the stackyard, which happens usually near the end of September, the ploughing of the stubble is begun; and wherever the stubble land is stiff, such portions are the first to be attacked. If such a portion be foul, it is ploughed only 3 inches deep; after which it is harrowed first with the ordinary harrow and then with the drag harrow. The weeds are then shaken up, collected, and driven off to be made into compost. The land is then ploughed again, but this time with a deep furrow. The stiff portions that are clear of weeds are ploughed with two furrows at the same time, the first about 3 inches deep, the second, immediately behind, about 6 inches deeper. The farmer believes that this method gives him less work in spring. The lighter or loamy portions of the stubble land are ploughed only once, but with a deep strong narrow furrow, and are left thus till spring.

The spring preparation for turnips is not elaborate: all that is done is to stir the ground once or twice with the grubber, and then, after harrowing, to open up the drills and spread and sow the manure. All the manure made upon the farm is applied between the drills to the turnip crop, and the quantity is about 15 loads to the acre. The only additional manure is 3 cwt. of ground coprolite to the acre. Should there be, however, insufficient farmyard manure for all the turnip land, then for the above the following is substituted:—

1 cwt. nitrate of soda or ¾ cwt. sulphate of ammonia.
2 " steamed bone flour.
1 " ground phosphate.
1 " muriate of potash.

The quantities of turnip seed sown are—of yellows 3 lb., of swedes 4 lb.; and the varieties of turnip grown are Glenlogie

yellow and purple top swede, with an acre or two of green top swede.

The top of the turnip drill is rolled flat by rollers behind the seed tubes. The soil is stirred with a drill grubber both before and after the turnips are singled, the turnips are cleaned again by hand hoeing, and finally a shallow furrow—a water furrow—is drawn between the drills. Early in winter 5 or 6 acres of turnips are stored for use during stormy weather. The remaining turnips are left in the field untouched, and were it not that it is unsatisfactory and sometimes impossible to pull them during frost or a snowstorm they would all be left in the soil, because the cattle seem to prefer them fresh from the field.[1] The farmer's plan with the stored turnips is to pile them up round the outside walls of his steading on the north and east sides, and to cover them either with potato shaws or horse litter.

Land after Roots.

After turnips the land is prepared for barley or oats by a single ploughing which may be undertaken at any time, provided the land is clear of turnips, from November to March, and which, in the case of stiff land, is undertaken always as early as possible. Land, and especially stiff land, that has been ploughed early is dragged with the drag harrow before sowing time in order to produce a better tilth. Six bushels of oats and 4 of barley are sown to the acre, and the treatment of the land is similar to the treatment when oats are sown after lea, with this difference that, before the third turn of the harrows, about 2½ cwt. of a local manufacturer's corn and grass manure are sown, and before the sixth turn—the last—the grass seeds are sown. The grass seeds are sown within a week of the grain, and to the acre they are as follows:—

1 bushel of perennial ryegrass (25-28 lb.)
3½ lb. of Italian ryegrass.
2 " cock's-foot.
1 " meadow fescue.
½ " timothy.
3 " red clover.
1 " alsike clover.
1 " white clover.
½ " yellow clover (*Trifolium minus* or *procumbens*).

[1] The storing of so few turnips is permitted only because the feeding bullocks and heifers are all off to the butcher shortly after New Year,—which means that, by that time, the larger portion of the turnips has been consumed. Were the farmer to keep a full stock of cattle right through the winter, he would store more turnips and store them early.

The return in oats is about the same as in the case of oats after lea, and in barley about 5 quarters, 56 lb. to the bushel, 2 bushels of light barley, and 1 ton of straw.

Hay Crop.

The hay crop is cut by a mower with the knives as near the ground as possible, and the farmer believes in cutting before the anthers begin to hang out from between the pales—that is, before "flowering." The day after it is cut the hay is put in small coles; in a few days more three of these small coles are built into one; and, finally, the hay is built in the stackyard in stacks of about 5 or 6 tons. The crop of hay amounts to between 30 and 35 cwts. to the acre. The aftermath is usually good, but before it gets too rank the cows and calves are put on to it. After a short time, any cows whose calves are ready to be weaned are taken away, while the calves are left.

Pastures.

The only treatment of the pastures that need be mentioned is that cattle are sometimes fed with small quantities of cake upon the first year's grass, so that they may be sent to the butcher off the grass or early after being taken into the house. The farmer has been in the habit of letting his winter pasture to a flockmaster, but he is not satisfied as to this being good policy, for if a lot of grass were ploughed down on the lea, he is not sure that the increase to be got in the oat crop by this is compensated for by the small amount he gets at present from the flockmaster. No sheep are ever allowed upon new grass after Christmas. As has been already mentioned, any part of the third year's grass land that is not doing satisfactorily is ploughed down in spring and sown with equal quantities of beans, peas, and oats. If none in particular of the third year grass land requires to be so treated, then the stiffest of it is ploughed and sown with this mixture. In this practice the farmer has great belief, since, in addition to having so much green fodder where he would have had a poor pasture, he can also put his cattle early into the house without waiting for the turnips. Sometimes the third year's pasture is top-dressed with road scrapings or any other similar materials that may be happened upon.

Live Stock.

The live stock of the farm consists entirely, with the exception of some poultry, of horses and cattle. There are six full-

grown Clydesdales, four of which at least are mares. Two foals are bred annually, and the stock of growing horses consists therefore of two foals, two yearlings, and two two-year-olds.

The foals are nursed by their mothers at pasture until the mares are wanted for harvest work or are sold. After they have been weaned and all through their first winter (*i.e.*, when rising one year old) the foals get a feed—about 4 lb.—of oats daily, with hay or bean and pea straw, and also, during suitable weather, the run of a pasture field which has not been, or is not to be, eaten by sheep. They get similar winter treatment when rising two years old, excepting that they get a feed and a half of oats daily. When rising three years old, until when they are broken in, they get two feeds of oats daily. The young horses are broken in when rising three years old just in time to take the place to some extent of the mares that are in foal; and when broken in their feed is that of the grown horses—viz., 12 lb. of bruised oats and 2 lb. of bran daily, with hay or pea and bean straw *ad lib.* Between turnip seed time and harvest all the horses are at pasture, and get a feed of oats only at such times as they may be wanted for work. With such a stock of young horses rising to take the place of older ones, the farmer is able to sell about three animals every two years.

In spring and summer the cattle stock consists of 18 cross cows, 30 calves (12 of which are bought in), 18 yearlings, and a bull. In winter these become 18 cows, 30 stirks, 30 feeding bullocks and heifers rising two years old, and a bull. Of the cows four are required for the house and the men. Three or four are annually sent to the butcher, and their places are taken by two-year-old heifers with their first calf. As these two-year-olds cannot do more than nurse their own calves, it falls to the ten remaining cows to bring up the six-and-twenty remaining calves. Some of the cows suckle two calves, others three—first two and then one—and there are usually a calf or two brought up on the pail. Calves are dropped from New Year till early summer, and are weaned in autumn. Cows and calves are never taken into the house till after harvest. When the cows are in the house and giving milk, their feed is about 120 lb. of turnips daily, along with which it is found that they consume about 14 lb. of oat straw. The only exception to this is in the case of a cow with insufficient milk to bring up the third calf, which gets, in addition to straw and turnips, about 2 lb. of linseed cake or cotton cake. The farmer has found that bruised oats, although well enough for the cow, are apt to scour the calf.

When the stirks (that is, the lately weaned calves) come into the house in the autumn they are fed with beans and peas, but, when these are done, the feed commences at about 20 lb. of

turnips, 1 lb. of linseed cake, and oat straw *ad lib.* During winter, when the weather is good, the stirks get a daily run upon the pasture. About the beginning of May they go to the pasture for good, and remain there till "the bees get no more honey on the clover," which is usually about the 20th of August.

The animals that lately were stirks are now feeding bullocks and heifers tied up to be fed for the butcher, to whom they go at from twenty to twenty-two months old. Their daily feed at first is green fodder, consisting of beans, peas, and oats, but when this is done it is about 120 lb. of turnips, 2 lb. of bruised oats, and about a stone (14 lb.) of oat straw. By the time they go to the butcher the cattle weigh from 9 to 10 cwt. live weight.

Income and Expenditure.

In order to exhibit still more clearly the state of such a farm as we have been shortly describing we shall now place side by side columns of income and expenditure. It must be understood, however, that some of the figures are only an approximation, the need for which arises out of the fact that this farmer, like others, has not kept separate accounts for the farm and the house—a state of affairs about as unsatisfactory as it possibly can be, for the reason that unless the accounts are kept separate no one can tell the profit or the loss resulting from his business or the amount of his household expenses. And the result may be that a farmer who lives too expensively and who sees his bank book looking blacker and blacker thinks his farm is not paying; whereas the true explanation of the decrease at the bank is that he is living beyond his income. We may also have the contrary condition of a farmer who lives plainly seeing his bank balance rising higher and higher and thinking therefore that his business is prospering, while all the time his accumulating funds at the bank can be accounted for by the fact that he is living at less expense than he could do were his whole farm capital invested in Government stocks or in some other secure but not too highly remunerative investment, and, besides, with all the energy expended in the management of his farm unrepresented by a single shilling. With other businesses the accountant sets aside a sum as interest on the capital and another as salary for the manager—the farmer is usually capitalist and manager in one—before he determines the profits; and why should not the same be done with the farmer's business? If business men find it necessary to look at their business as their business and their house as their house, should not the farmer make an effort to ascertain what his house may get from his farm, and what, on the other hand,

his farm may get from his house, so that he may know the position of each?

It will be seen, therefore, in the income and expenditure account below, that the house is charged with the milk of four cows, with a sum for potatoes (which are usually grown in some field near the house independently of how the rotation may be affected), with a sum for working the garden and for the use of the pony, and also with the rent of the house; while, on the other hand, the house is credited with the cost of feeding three unmarried men and with a sum to represent the services rendered in milking four cows, in looking after calves that may be brought up on the pail, in looking after the poultry, and so on. It is possible the farmer's wife may not use all the eggs and milk she buys from the farm, and that she may even make a profit in selling them again, but that is a matter with which the farm has nothing to do. The farmer sold them to his house at a good price, and any further profit made upon them has been earned by another business.

INCOME.

26 bullocks and heifers sold	£468	0	0
4 cows sold	68	0	0
Horses sold (average of several years)	50	0	0
Barley sold	80	0	0
Oats sold	140	0	0
Hay sold	15	0	0
Turnips sold	20	0	0
Received for winter sheep-grazing	10	0	0
Sold to house, viz.—			
Milk of 4 cows for twelve months	72	0	0
1½ acre of potatoes	20	0	0
Eggs and poultry	25	0	0
Working garden and use of pony and boy	10	0	0
Rent of house	15	0	0
	£993	0	0

EXPENDITURE.

Wages of 4 married men	£200	0	0
Wages of 3 unmarried men	90	0	0
Board of 3 unmarried men	55	0	0
Payment for milking cows, &c.	30	0	0
Milk for calves fed by pail	5	0	0
Extra labour in harvest	12	0	0
Twine	3	0	0
Blacksmith	22	0	0
Joiner	6	0	0
Saddler	7	0	0
12 calves bought in	36	0	0
Manures	60	0	0
Grass and clover seeds	21	0	0
Linseed cake	14	0	0
Use of stallion	6	0	0
Insurance	6	0	0
Veterinary surgeon	2	10	0
Rent	210	0	0
Taxes	5	0	0
Interest on drains	6	0	0
Buying and selling and other incidental expenses, say	20	0	0
Replacing implements	10	0	0
Losses by death, chiefly calves and stirks (average of several years)	20	0	0
Interest on capital	75	0	0
Management, say	71	10	0
	£993	0	0

EFFECTS OF SOLUBLE AND INSOLUBLE PHOSPHATE ON THE TURNIP CROP.

By John Milne, Inverurie.

The experiments upon the effects of soluble and insoluble phosphates on farm crops begun by Mr Jamieson for the Aberdeenshire Agricultural Association in 1875 aroused considerable interest, and led to a number of experiments by others. While long experience showed that the insoluble phosphate of lime in bones became gradually available for plant sustenance, it was generally believed that the insoluble phosphate of coprolites and other phosphatic minerals were of no use unless dissolved by sulphuric acid. The experiments made by Mr Jamieson clearly showed that the insoluble uncrystallised phosphate of lime in minerals, although more slowly available than soluble phosphate, did supply plant food, and that most kinds acted quite as quickly as bones crushed roughly, as they are in the ordinary bone-meal of commerce.

The discovery of phosphorus in basic slag, which is produced in large quantities, and was for some time sold at a cheap rate, diverted attention from the use of other mineral phosphates; but the opening up of the immense deposits of mineral phosphates in Algeria, Florida, and other countries, has rendered these so cheap that it is of the utmost importance to the farmer to consider whether he cannot use these in whole or in part, instead of the dearer phosphate in superphosphate, basic slag, and crushed bones. The price of all kinds of phosphate of lime is now so low that the farmer who starves his crops of it certainly does not make the most of his opportunities, and were the quantities used in the United Kingdom doubled, it would probably do more to revive agriculture than any other remedy in sight. Good ground mineral phosphate, 56 to 58 per cent, can be had for 2s. per cwt. If three cwt. per acre is applied continuously it would double the grass on poor soils, and this would in time greatly increase the productiveness of the other farm crops.

Mr Hughes of Fenchurch Avenue, London, has taken out a patent for rendering superphosphate alkaline by the addition of lime, which has the effect of precipitating the phosphates or rendering them insoluble in water. Precipitated phosphate can also be bought in the market, being a by-product in the manufacture of glue from piths by the acid process.

To test the effects of precipitating the phosphate of lime in superphosphate on crops, and to compare it with that made in

glue-works, and with some other commonly used insoluble phosphate, I arranged with three farmers, well known for their experience in conducting experiments, to undertake the carrying out of a small experiment on turnips. These were Mr William Norrie, Cairnhill, Monquhitter; Mr James Cowie, Haremoss, Monquhitter; and Mr William Strachan, Upper Muirden, Turriff, who carried out the experiment carefully and intelligently. The results are given in the following table:—

RESULTS OF EXPERIMENTS TO TEST THE EFFECTS OF VARIOUS PHOSPHATES ON TURNIPS IN 1901.

Manures applied=128 lb. of phosphate of lime, 1 cwt. nitrate of soda, and 1 cwt. muriate of potash, per acre.

	Muirden.				Haremoss.		Cairnhill.				Bulbs only. Average weight.	
	Swedes. No dung		Yellows. Dunged in autumn.		Yellows. No dung		Yellows. No dung		Yellows. Dunged 18 yards.			
	T.	cwt.	T.	cwt.	T.	cwt.	T.	cwt.	T.	cwt.	T.	cwt.
Superphosphate . . .	13	13	17	13	16	8	13	12	16	16	15	12⅖
Do. and lime . .	11	19	18	2	17	14	14	4	18	0	15	19⅘
Precipitated phosphate .	11	9	17	0	14	15	13	1	16	5	14	10
Do. and lime . .	11	10	16	14	15	3	13	1	17	17	14	17
Slag phosphate	10	14	16	15	13	16	12	7	17	1	14	2⅗
Peruvian guano	13	15	17	3	14	17	10	10	18	16	15	0⅕
Bone-meal	11	0	16	9	12	6	5	5	16	7	12	5⅖
Do., fine	12	0	17	1	12	2	7	6	16	16	13	1
Bone-ash	11	10	15	10	11	15	11	9	16	10	13	6⅘
Algerian phosphate . .	12	5	16	0	11	10	13	19	18	2	14	7⅕

	Tons	cwts.
Average produce from common Indian bone-meal .	12	5⅖
Average increase from using fine bone-meal . .		15⅗
" " bone-ash . . .	1	1⅖
" " slag phosphate . .	1	17⅕
" " Algerian phosphate .	2	1⅘
" " precipitated phosphate .	2	4⅗
" " do., with lime	2	11⅗
" " Peruvian guano . .	2	14⅘
" " superphosphate . .	3	7
" " do., with lime	3	14⅖

The plots were each 1·112 acre. The quantities of phosphate of lime applied to each lot was 128 lb. per acre; the nitrogen, so far as not existing in the manure, was made up to equal 1 cwt. of nitrate of soda, and to each plot was added muriate of potash equal to 1 cwt. of 80 per cent muriate of potash per acre. The quantity of lime used with the superphospate was 1·5 of its weight, equal to 90 lb. of ground lime per acre, and the same

with the precipitated phosphate. The precipitated phosphate contained fully 2 per cent of chloride of calcium, which is injurious to plants, and may account for its effect being inferior to superphosphate precipitated with lime. The bone-ash was rather roughly ground, otherwise it might have shown somewhat better; and the Algerian phosphate was also somewhat roughly ground, over 40 per cent failing to pass a mesh of 10,000 to the inch.

It would seem that the precipitation of the soluble phosphate in superphosphate by lime has no injurious effect upon its action on the turnip crop, and that on soils deficient in lime it may have a beneficial effect. Whether it will have a favourable effect upon preventing finger-and-toe disease remains to be seen. Details are received of the time of sowing, hoeing, lifting, and numbering of plants in plots, but these do not affect the comparisons.

In every case the first four plots—superphosphate and precipitated phosphate—looked the best in the first stages, with little apparent differences between them.

Mr Norrie's remarks on the plots that received no dung are here given, as they relate to some anomalies in the weights. He says: "Superphosphate in all the experiments did well in both trials; bulbs and tops increased by the lime; precipitated phosphate plots also very good; no increase by lime without dung. Slag phosphate plots turned out better than they looked. Peruvian guano plots had good tops, but bulbs not in proportion. Bone-meal seemed to have a poisonous effect, as a number of the plants died after singling, and others quite stunted. Bone-ash plots fairly good, deficient in tops. Mineral phosphate plots very equal, both healthy looking."

HAY AND SHEAF SHEDS.

By Richard Henderson, F.H.A.S., Portland Estates Office, Kilmarnock.

Economy of labour must continue to be more and more observed if British agriculture is to flourish in face of the universal competition it is now subjected to. If, therefore, we persist in the cumbersome and roundabout method of securing ear and stem of our respective grain crops combined, it will soon become imperative that the homestead be provided with efficient shelter for unthreshed corn as well as for live stock.

The erection of a series of small stacks or ricks, leaving them

to be thatched as opportunity afterwards affords time to do so, is hardly the thing in these days. Much time is taken up in both operations. The thatching process interferes less with the business of harvest, because it can be done later. The longer it is put off, however, there is the greater risk of damage to the contents of the rick. And whether done late or early, it implies a waste of valuable straw—valuable on account of the labour bestowed on its preparation for the job, and because only the best will serve the purpose. Further, when its end has been accomplished it is usually only fit for removal to the dungstead.

At those farms where dependence is put on the itinerant thresher it matters little where the ricks are built, so long as the engine and mill can draw up alongside them and obtain a firm stance. In these cases labour during harvest is economised by storing the crops in the fields which grew them, the afterwork of carting grain and straw from the mill being arranged for at any time suitable, and thereby being less felt than under the ordinary circumstances of carting the stuff right off to the homestead when ready for being put into bulk.

But at those farms where the practice is to remove all the corn crop to the homestead during harvest, to be dealt with by the home thresher at stated intervals of close recurrence throughout winter and spring, there can be none of this putting off to a more convenient season. It is only practicable in the districts where farming is a little mixed. It is common throughout the south-west of Scotland, and here and there in the centre and in the east; but in the latter parts of the country, farming there being, as a rule, of a more intense nature, it cannot so easily be adopted. At farms of this description the amount of corn crop to be handled during harvest makes every plan that helps to lessen or quicken the work involved a great boon to the farmer.

Advantages of Sheaf-Sheds.

And surely roomy sheds, in which the sheaves can be quickly stowed away without the farmer having to go through the trouble of first building small stacks and afterwards coating them with thatch, must rank high in this connection. Less time is taken in packing the sheaves in these sheds than is required in the case of a rick; and when the shed is full nothing remains to be done to safeguard the contents against wind and weather. During operations the shed may be filled as the sheaves become available. A single cartload can be stowed away and left there until more is forthcoming. Not so with the rick, however. Once started upon it must be completed, or else, if left unfinished, it must be carefully protected against wind and rain. Under shelter of the shed it is practicable, in fact, to

leave the loaded cart itself whenever such a proceeding is necessary. And this advantage repeats itself when the sheaves are being removed to the thresher.

Advantage of Hay-Sheds.

Even more marked in this respect is the advantage of having a hay-shed at the homestead. Hay cannot be put together in small ricks so handily as corn-sheaves may. It is more convenient, as well as being better for the material, to build it in considerable bulk. But to be caught by rain when this is going on is a common experience. This means a waste of hay and a waste of time in the general upsetting of arrangements for the time being. The whole operation having to be tackled at one time, any stoppage thereof before completion leads to confusion all round. Waterproof sheets have to be spread over the unfinished rick, that is to say if there be enough about the place. If there is not, substitutes of some kind have to be produced. But usually this casual protection is of a primitive and rather ineffective description, and loss is in consequence entailed.

With the shed at disposal, however, there is nothing of this. One is then at liberty to set about the work piecemeal or by degrees, to deal with the hay either as it comes into order or as favourable blinks of weather intervene, instead of having to hold on for a probably long enough interval between showers to enable the whole to be handled in one combined operation. And once it is in the shed there is no anxiety with regard to protecting it from rain. The roof is there for that purpose, whether much or little is laid therein at a time.

The advantages of the shed, whether for corn or for hay, are not confined to the inputting of the material. When the stuff—more especially the hay—comes to be used, there is no preliminary stripping off of thatch to be done, and it can be taken as wanted without fear of the remainder suffering from exposure. The contents of the rick that has been broken into must all be taken under shelter, at least as much of it as has had its share of thatching disturbed, unless what it is convenient to leave behind has been temporarily thatched anew. But all this pottering about means loss of time and waste of stuff. It is very handy when a cartload or an armful of hay can be taken at any odd time without having to trouble oneself over the weather-resisting condition of the remainder. It is sometimes convenient to be able to act similarly with the corn-sheaves too. A cartload, or a half even, can be carted away at any time without submitting the remainder to risk. And often pelting rain comes before the sheaves can all be removed from the rick. In both cases the shed thus renders the farmer independent of

weather to a very considerable extent, so far as concerns the housing of the stuff and its after-utilisation.

Horse labour might be dispensed with entirely on threshing days were there a full set of shedding placed handy to the threshing-floor. Under an arrangement of this kind, with a system of rails leading from the sheds up to the side of the mill, and handy trolleys to run thereon, the carrying of the sheaves from shed to barn might wholly be done by women. One female would be able to load, push along, and discharge a trolley on her own account. All the assistance she would require would be some one to pitch the sheaves to her from the far side of the shed or sheds. For that part, indeed, it would not require the exercise of a great amount of ingenuity to rig up a travelling-band that would deliver the sheaves directly alongside the thresher. The force that gave power to the mill could spare power for this too. It is common to have some arrangement of this kind for delivering the threshed straw as it issues from the mill. The same sort of appliance need meet with no insuperable difficulties at the initial end of the threshing apparatus. Where it could be contrived, on grain-growing farms it would mean immense economy in the handling of the crops during threshing It could only be carried out, however, where ample shedding, planned for the purpose, was available.

What an amount of labour would, we often think, be saved to agriculture were it practicable to secure the ears of grain separately from the straw! This, however, is not our custom: we must deal with matters as they are, and there are few, we daresay, who will deny that shedding accommodation at the homestead for corn crops, as well as for hay, is now quickly becoming a necessity. Who is to bear the cost of meeting it? Whether landlord or tenant on his own account, or whether the affair is to be a joint one, is not a subject for discussion here. But whoever has to bear the burden, it is evident that it will soon have to be shouldered by some one. We shall see as we proceed that it is no plaything to be taken up lightly and borne along with ease.

Temporary and Permanent Sheds.

If the tenant takes upon himself the responsibility of erecting the necessary shedding, or at any rate what he considers will, under the circumstances, relieve him of severe strain upon his resources of labour, he may be pardoned in setting up erections of a somewhat temporary description; but if the business is taken up by the proprietor either wholly or in the greater proportion, something of a permanent character should be faced. A building of brick or stone gables and side pillars,

with a slated roof, would of course constitute a lasting thing of the kind. A less permanent erection would, however, serve the purpose equally well,—in many respects better, in fact,—and be the means of sinking less capital and calling forth less interest, if such were involved in the business; besides, it would give one a freer hand should any rearrangement of the homestead crop up in the future. So long as the homestead proper is laid down on sound lines at the start, we would advocate the buildings thereof to be as permanent as well-built stone-and-lime walls and sound-timbered roofs imply. But there is not the same need to deal similarly with such subsidiary buildings as those we are concerned with just now.

Construction of Hay-Sheds.

What will serve as a shed to hold hay will do for corn too, and conversely. Still, it is generally the custom to construct the hay-shed on better lines than the corn-shed. Turning our attention to the hay-shed first, we meet with it erected with one kind or one or two kinds of material at one place and different materials at another, all, as a rule, much in accordance with fancy. The class of suitable material nearest to hand, when reasonably to be had, has often a good deal to do with this variance; but following the lead of others has more. There is less choice in the roofing material than in the others that go to the building of the shed. For the roof itself, slates and galvanised corrugated-iron sheets are, we may say, the only two we have to select from. There are others offered as substitutes in the market, but they make little headway. When we have chosen the covering of the shed, there remains but the framework to support the same, and the posts or pillars upon which this frame rests. Stone or brick, wood, and iron are the three materials we are free to adopt in the latter connection; and wood and iron for the former. The diversity seen in the construction of these sheds is evidently, therefore, more on account of the many methods of adapting the few materials mentioned to the end in view than from the variety of the materials turned to account.

The Slated Shed—Stone and Brick Pillars.

The shed with stone pillars and slated roof is most seldom met with. Figs. 6, 7, and 8 give respectively the elevation of the side, the elevation of the end or gable, and the ground-plan of a shed of this type. A stone pillar or butt requires to be thick—if built of rubble, that is to say. One built of square dressed stones could do with much less room, but work of that kind is too expensive for homestead work. This thickness of

the rubble wall means a loss of storage room under cover of the roof, as a glance at fig. 8 will at once make plain. Whatever of the space within the dotted line is taken up by the supports of the erection means either a robbing of the space so roofed over

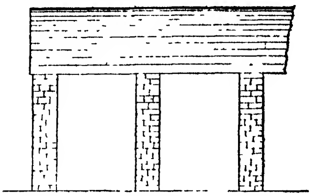

Fig. 6.—*Side of slated shed on stone pillars.*

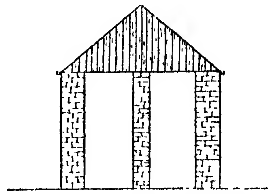

Fig. 7 —*End of slated shed on stone pillars.*

or a larger roof than is necessary—both one and the same thing so far as expense in building goes.

Making use of brick instead of stone, as in figs. 9, 10, and 11,

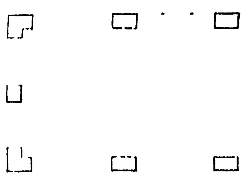

Fig. 8.—*Plan of shed with stone pillars.*

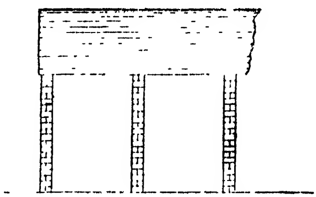

Fig. 9.—*Side of slated shed on brick pillars.*

saves to some extent this waste of room. The bricks allow of thinner as well as narrower pillars. If built 13½ inches (*i.e.*, brick and half) deep, and say 18 inches or two bricks in width,

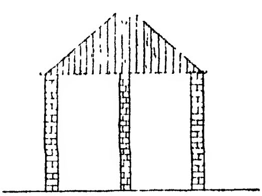

Fig. 10.—*End of slated shed on brick pillars.*

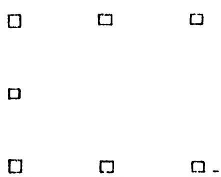

Fig. 11.—*Plan of shed with brick pillars.*

ample strength is afforded. A pillar of this description, shown in three sections in fig. 12, is as strong as the stone pillar in the first three figures, a section of which, to the same scale as before, is given on fig. 13. The stone may certainly hold its own should

a cart collide with it and knock out half its breadth. If well built to begin with, it can suffer the loss of a good deal of its sectional area without collapse. It will suffer a goodly lump of its side to go without complete fracture taking place, and what remains will hold together until repair can be made.

With the brick pillar instanced there is less to come and go upon. The force that would carry away half of its breadth

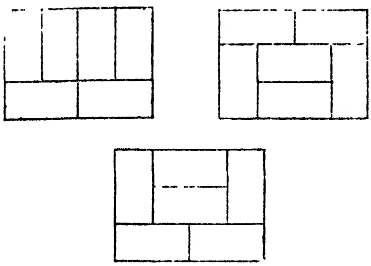

Fig. 12.—*Sections of brick pillar.*

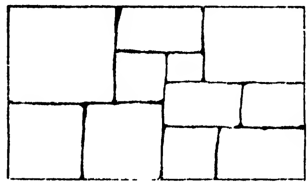

Fig. 13.—*Section of stone pillar.*

would be as likely to take the whole with it. We can, of course, add another half brick to its width, as in fig. 14. Adding to the thickness or depth of the pillar would increase the general stability thereof, if it did not afford a surplus that might be shorn off without disaster. We would prefer, however, not to have the pillar much thicker than the surface that comes

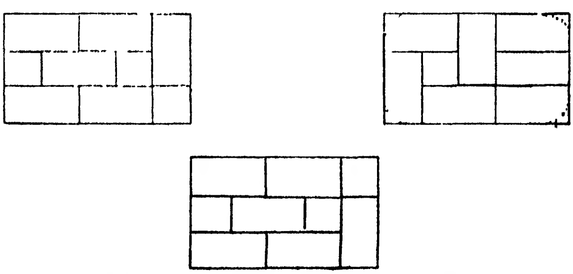

Fig. 14.—*Sections of enlarged brick pillar.*

under the direct pressure of the roof-frame, as it bears upon the wall-plate.

But the pillar, the section of which is given in fig. 11, if carefully put together with Portland cement mortar, is of sufficient strength to withstand the ordinary risks of farm practice. It will be noticed that we show one section in each figure with the corners rounded off in dotted lines. There are corner-bricks of this kind manufactured, and their use tends a

good deal to the security of the pillar. The cart that happened to come against any of the corners of the pillar, were these left square, would hold until something gave—either bricks from the pillar, or part of the cart, or the harness. But with the corners rounded off as indicated there would be nothing for the movable body to take a firm grip of. It would slide round the obstacle instead of holding on as before. But contingencies of this sort are of rare occurrence, and may almost be left out of account.

The wood or iron posts are also liable to an accident of the kind, but hardly to the same degree, seeing they occupy less space, and are consequently not so much in the way. After all, however, it is but a poor kind of shed that cannot hold together for a while after one of the supports has been knocked from under it.

We give three sections in each of the figs. 12 and 14, in order to show that the successive courses of brick must be laid differently from those adjoining them both below and above, otherwise the pillar will not be got bound together in the strongest way. The introduction of the extra brick and half in fig. 14 admits more variation than is possible in the section given in fig. 12.

The post, either of wood or of cast iron or steel, is a commoner accompaniment of the slated roof than the stone or brick pillar. Both the wood post and the iron column are handier than the brick butt, and, besides taking up less room than it, they afford greater stability to the shed. The brick pillar will snap more readily than they will if the shed comes under the influence of a force that tends to overset it. In situations exposed to high winds it is a frequent experience to see sheds of this nature overturned. But wherever the site of the shed is protected, bricks may without hesitation be taken to serve as material for the supports thereof—that is to say, when a slated roof is chosen. For an iron roof they are not suitable. This is so light that unless firmly held down by the pillars or posts it is very liable to be blown off.

The Framework of the Roof.

When the slated form of roof is the one adopted, the framework is usually put together after the manner of that used for the other buildings. The ordinary couple-and-baulk roof-frame, as in fig. 15, is generally avoided, the baulks or ties in connection therewith being against the storage room within the shed. These ties being only 16 inches or so apart, are very much in the way in a building of the kind. To obviate this they are sometimes placed as high on the couples as possible. But to

be of full effect the tie, when one alone is used, or the lower one where two do service, should be little more than 18 inches above the level of the line joining the feet of the couple. By placing them much higher we bring into play a force that causes an outward thrust on the wall-plate and its supports, which are intended to carry a down-bearing weight alone. There would be little headroom, however, in a shed with so many ties all close down to the wall-plate.

In order to remedy this, the type of roof which is characterised by the principal couple, as represented in fig. 16, is turned to account. In this instance the couples are from 8 to 10 feet apart, instead of 16 inches as in the ordinary method of roofing Scottish farm-buildings, the spaces between being unobstructed and affording clear headroom to the roof. This arrangement, it requires little reasoning to prove, is much preferable to the other. It is not the best, however. The ties in this case, it will be observed, though much farther apart than in the other, are lower down. Their position makes it

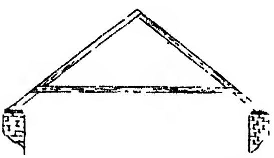

Fig. 15.—*Common couple-and-baulk roof-frame.*

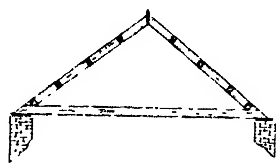

Fig. 16.—"*Principal*" *roof-frame.*

almost impossible, even when one tries, to keep the hay clear of them when the shed is being filled. The consequence is that as the hay settles down undue weight is impressed upon these ties. Many a one have we seen fractured in this way.

It is plain, therefore, if the shed is planned with ties of the kind we refer to, they must be placed high enough overhead to be out of danger from the subsiding hay as it packs together, else we must sacrifice all the space in the shed above wall-head level, a waste not to be contemplated. It is impracticable to place the tie of the principal couple or rafter higher than the level of the wall-head; and to place that of the common Scotch roof much higher than we have already quoted counteracts its purpose. Either type of roof, then, is evidently unsuited for the hay-shed. It is quite practicable, as we shall demonstrate when dealing with the circular iron roof in connection with the hay-sheds, to dispense with ties altogether in its construction. Fig. 17 is a good instance.

But matters are on quite a different footing with the ridge or pitched roof, which is compulsory when slates are the covering.

If the framework of the slated roof is not held well together towards the base of the triangle formed by the two sides thereof, the latter will push apart. The ties are intended to hold them together, but if they fail to do so effectually, the amount of strain they allow to pass must be taken up by the side parts or pillars. These, as we hinted above, are arranged on the principle of having a steady weight to support without any disturbing element, such as an outward thrust at top, to contend with. Certainly they are set up with a view to each one taking part in the stability of the erection as a whole, to guard against overturn and uplifting. Under these circumstances each is a help to the others; but cross-purposes come into play when a force tending to dissociation arises here and there among the various parts, or it may be all throughout the affair.

The type of roof-frame depicted by fig. 18 lets us out of the difficulty a little. It is a sort of compromise between tie and no tie. Couples put together in this manner are bound to straddle more or less if the tendency thereto is not firmly re-

Fig. 17.—*Girder roof-frame.*

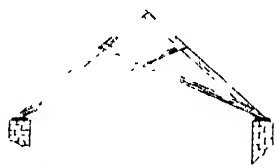

Fig 18.—*Crossed-tie roof-frame.*

pressed. There is nothing to act as a check in this respect, however, but the wall-plate, which, as we have already pointed out, has work of another kind set it. By adopting this method of framework for the roof we escape the risk of harm to the ties. We get more headroom, too, inside. But, on the other hand, we introduce into the fabric of the shed the disruptive tendency already referred to.

The couple of the kind we are describing, if adopted, helps to make a more efficient shed if set up as a principal. This no doubt increases the liability of the roof to spread. If the couples are placed close together, as in the ordinary manner, the strain in that direction is more generally distributed, and therefore less effective than when concentrated at points pretty far apart, as happens when the couples are treated as principals. But with so little space between as there is in the case of common couples, those who are set to stow away and tramp the hay are greatly hampered in the operation when the stuff has raised them to the roof. With the couples farther apart the packers have more room to move about in, and the shed may be filled close up to the roofing-boards in the wider spaces.

Principal couples of this description, when used in sheds not very well adapted to withstand much outward thrust, are perhaps far enough apart with spaces of 5 feet between. There might be one at any rate in the space between pillars, which are sometimes 10 and sometimes 12 feet apart, as circumstances call for. The shed with stone pillars or butts is the one best

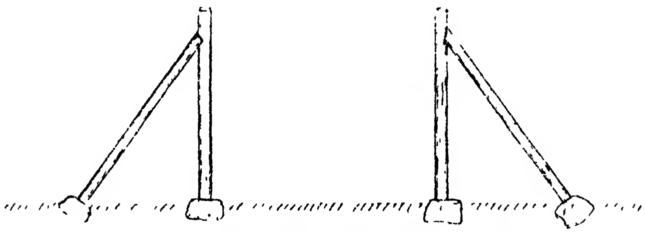

Fig. 19.—*Shed posts and struts set on stones.*

adapted for roof couples of this description, because the breadth and weight of the former give them a stability greater than is inherent in those of brick, or in the wood post or the iron pillar. When used in connection with side-posts of wood it is necessary to fix up side-struts as in fig. 19. But these are always in the way.

Pillars and Posts.

Nothing special is required in the preparation of the foundation for the built pillar or butt, whether of stone or of brick. What answers for a wall of either material built to the same height and breadth of these is quite sufficient.

There is more diversity of method in setting up the post and column. If the wood post is to be depended on by itself for affording steadfastness to the shed, its lower end must have a firm grip of the ground, and to make sure of this each post must be sunk between two and three feet therein. This insertion in the ground, as we all know, is a trying position for wood to be subjected to. Some kinds of wood stand it better than others. The heartwood of oak and larch, for instance, both last far longer than our ordinary pine and fir woods do under these circumstances. We can protect the wood sunk in the ground, however, in such a manner that it may successfully resist the process of decay, which speedily develops when left therein in the manner that applies to the post, and so put common fir wood on equality in this respect with either oak or larch. If laid on and surrounded by well-mixed Portland cement concrete, carried well up above the surface of the ground, the wood inserted therein is secure against the adverse influences of such a position.

The farthest down portion of wood sunk in the ground lasts longest. There it is under more regular conditions than nearer the surface. It does not become wet and dry alternately, which is a severe trial to the constitution of timber. It will stand good for a long time if kept constantly wet, and at the same time not much under the influence of air. The nearer we come to the surface of the ground this becomes more difficult of attainment. A point two or three inches therefrom is the critical part in the sunk position of the post. There every fall of rain affects it. At one time the soil around it is comparatively dry, at another soaking wet, while all the time air has free access to it. The oxygen of the atmosphere, always ready to induce decomposition in every substance it is capable of affecting, is there given a full opportunity, of which it is not slow to avail itself. Oxygen has no immediately adverse effect on the wood so long as the latter is in a dry condition, but when it holds moisture amongst its fibres it is then at the mercy of this active element.

We can, as we have just said, successfully guard against these adverse influences which soil has on wood by using Portland cement concrete to keep the two from coming into contact. If we embed the sunk end in concrete and surround it until well clear of the ground in the same, there is little danger then of soil touching the post. With concrete beneath and a thick collar of the same all round, the end of the post is completely protected from ground-damp; and with the collar heightened a little as suggested, surface-water is kept away from the wood. None of the rain that beats upon the post directly, or that runs down on it from the upper part of the erection, can then lodge round the neck of the post about ground-level. The collar of concrete fits too close. By these simple means it is possible to keep the sunk part of the post in serviceable condition for a period in keeping with the kind and quality of the wood selected for the purpose, provided, of course, that only well-seasoned wood is used.

The end of the post, instead of being sunk, is often placed on the top of a large stone. This keeps it clear of soil and of surface water as well. Not if it be carelessly done, however. The top of the stone must sit clear of the ground, and the surface upon which the end of the post is to rest must be rounded off or made a little convex. If it be otherwise, slightly hollow or even flat, moisture will lodge between the wood and the stone, with the usual consequences to follow. A good daub of cement between the two will improve matters and assist to keep moisture at bay. Moisture has a wonderful faculty of gaining admission to joints even when gravity is against it.

But there must be some firm bond of union between post and

stone if the shed is to be rendered stable. If the posts are merely set on the stones the erection will go down before the first gale—it will be shifted from its stance at anyrate. Even when the post is fixed up in this simple way a dowel of some sort, as is represented in fig. 20, forms a junction between post and stone. But this is merely to keep the end of the post from sliding. It has no effect whatever in keeping it down to its place. Any puff of wind with energy enough to overcome the weight of the shed is at liberty to lift the erection from its position and throw it over. But the slate-covered shed, being heavier, is not so liable to become the sport of winds as one roofed with such a light covering as corrugated iron. To give a shed, more especially one of the latter description, the necessary degree of stability to hold its own in our boisterous climate, the posts and stones that take part in the erection must be firmly clamped together. To begin with, however, the stones must be of sufficient weight to hold the shed down in spite of

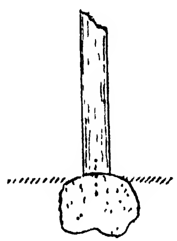

Fig. 20.—*Post dowelled to stone.*

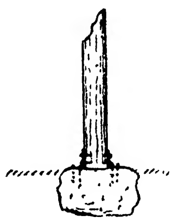

Fig. 21.—*Post strapped to stone.*

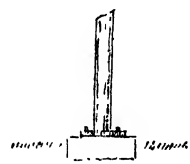

Fig. 22.—*Iron column bolted down to stone.*

gales. Thereafter, if the respective posts and stones are bound together as in fig. 21, the shed is pretty firmly secured in its moorings, and not likely to be dragged or driven therefrom. It is a cumbersome plan, however, only allowable where big stones are to be had for the seeking. Yet it is preferable to the one already instanced—fig. 19. There the posts are set on lighter stones, more to keep the ends from sinking in the ground than for any other purpose, although the instinctive idea that it is beneficial to keep them clear of the soil is never far away from the mind of the shed-builder, no matter how little he may be versed in these homely matters.

The concrete base serves the double part of preservative to the end of the post, and, clinging tightly to it, of adding considerably to its weight. It combines the respective offices of the big stone and the little stone, and performs them much more effectually. It is equally effective in the case of the metal column. Fig. 22 shows a common method of attaching the latter to a stone base. A biggish block is required here, too,

so that weight may be given to the column, for if not well weighted the shed would be lifted similarly to the one with unencumbered wood posts instanced above. What is more, the top of the stone has to be hewn smooth to allow a proper bearing for the base of the column, and both have to be let into the stone for the purpose of screwing the column thereto. But bolts and nuts are not suitable appliances to leave exposed in the manner they are sure to be at the farm at the base of hay-shed columns. They will be treated neither to paint nor oil, and soon rust will have them in its clutches. Such an arrangement answers under cover, but not very well in the situation we refer to.

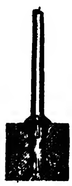

Fig. 23.—*Iron column with base set in concrete.*

Fig. 24.—*Angle-iron (or steel) pillar set in concrete.*

A much better arrangement is to provide the column with a base, something similar to what is shown in fig. 23. This goes underground and acts as a most efficient basis of security to the column. It will last a long time in the soil, but if surrounded in concrete in the manner we recommend the end of the post to be, its usefulness may be prolonged indefinitely, besides thereby having its stability much increased.

The above applies to the round hollow column, but it is being set aside for a cheaper article, such as we exemplify in fig. 24. These may be either of steel or of iron, and are rolled out or cast in long lengths which can be cut up as desired. They cost less and are handier than the column proper above referred to. The only practicable, while at same time thoroughly efficient and easily executed, method of fixing these columns securely in the ground is that of encasing the sunk post in Portland cement concrete as before.

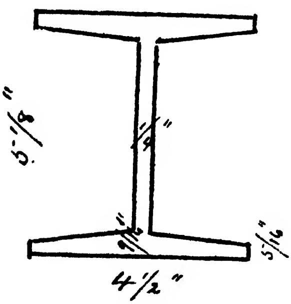

Fig. 25.—*Section of angle-iron pillar.*

Fig. 25 gives a section of such a column as the one shown in the last figure, from which we see how it is constructed to join lightness with strength. There is no need to sink the column unnecessarily deep. We may content ourselves if it is only 1½ foot in the ground, provided it be set in concrete as above. This adds manifold to the stability of the column, and further keeps the metal in a good state of preservation. The column may be either of steel or iron.

Steel gives us a stronger column with a smaller section, but there is no special benefit in having light columns for the hay-shed. The biggest of them do not take up much room, and there is plenty to spare. If the iron ones come in cheaper it is better, therefore, to select them, as being thicker and heavier than those of steel.

The Wood Post.

Our preference lies to the use of the wooden post in the erection of this kind of shed, but for what reason we can hardly tell. For one thing, timber is more easily handled by country-folks, and much more readily repaired. There is so much choice of wood, too, in most country places. On many an estate there are posts of various kinds available for the purpose. Any of our firs or pines will do, so long as the timber is mature and seasoned sufficiently. Spruce will stand well enough if the part underground be protected in the manner we have indicated, and ordinary care be bestowed on the part that stands exposed to the air. Silver fir will be found as good, if not better. Scots pine is better still. Larch is almost an ideal wood for the purpose.

Among the hardwoods, oak, when free of sapwood, is the most durable. It should survive several renewals of the other parts of the framework of the erection. But oak-trees of a size suitable for shed posts have a good deal of sapwood in their bulk, and this weathers away in time, leaving the post unsightly. Besides, it would never do to embed any of it in the concrete base. When decay begins in the sapwood then the sound wood might become affected on that account. Even if it escaped that, the vacancy caused by the decayed stuff would open the door to agencies that would soon break up the constitution of the remaining sound portion. It is possible, of course, but an expensive business, to saw off all the sapwood, leaving only the red or mature wood for use. This, one can understand, means a big tree to begin with, and when done we have a square post instead of a round one. That is no great drawback, indeed. Still corners on a shed pillar or post are, as we have already explained, a disadvantage.

Where possible, it is better to keep the tree that is to be devoted to supporting the shed in its natural shape. Moreover, when the bark is stripped therefrom, the unbroken surface underneath hardens into a sort of natural protective covering to the wood within—a far better coat than paint affords, and a permanent one, being part and parcel of the woody fibre of the timber itself.

Oak, for the reasons we have stated, is seldom suitable to act the

part of a round post. In fact, it is a little out of it as a post-supplying wood. Trees of a suitable size to act in their natural form have a good deal of sapwood about them, which soon succumbs when put to the purposes of timber. There is always a "bone" left within to stand good when the immature wood has weathered away, but a cankered-looking post of this kind is objectionable in appearance. Moreover, timber of this sort cannot be considered a firm basis of attachment for any cross-pieces or struts that may happen to be required for fixing up lining, for instance. Nails will not hold for long in the sapwood; and runners or boards that are fixed hard up against it to begin with, by-and-by grow slack on account of the failure of their backing.

Sweet chestnut is more suitable for the object in view than oak. In timber of this kind there is not such a sharp distinction between heartwood and sapwood as there is in oak. The wood, as regards its lasting qualities, is more uniform from centre to circumference. But although more uniform in character, it is not so durable as oak. The staying or lasting powers of the latter are due to the filling up of the cells of the woody fibre with mineral or organic matter. As this occurs the wood so affected gradually becomes proof against the ordinary causes of decay in timber. The replacement of the organic matters which accompany growing wood with more stable substances render it less vulnerable to chemical action.

Among our native woods oak is the one—of the large trees, at anyrate—most distinctly characterised in this respect. The process begins at the centre of the tree and works outward in the concentric circles of growth. In the part so affected life, if not at a standstill, is less active than elsewhere. The cells become indurated or hardened as the earthy matters—the insoluble carbonates and sulphates and other salts—accumulate therein. Life, as exemplified both by increase among the cells and of their catering to others still in the active stage, is virtually at an end. If devoid of organic life, however, they are in a condition fitted to resist decomposition. It is otherwise with the parts where life is still in full force. Then the cells are soft and full of moisture, and busy adding to their number as the new wood forms. Their contents, if not the general structure as well, are necessarily of a more or less soluble condition. Wood in this state, when turned into timber, can hardly be expected to possess much robustness of constitution.

The sweet chestnut, as we have said, is less extreme in this way than the oak; and it is competent to use trees of this kind sufficiently young to afford posts suitable in size as they stand without having to eat into them lengthwise, simply stripping off the bark and setting them up as they are. If we have the selection of some straight, clean-stemmed trees, our shed will

then have quite a handsome appearance so far as the posts thereof are concerned. The natural skin of the wood left unbroken will, as we have said, act as a capital protection against weather. It seals up the ends and sides of the fibres much more effectually than paint or tar can be expected to do with those that have been lacerated by the saw.

As regards the diameter of the trees to be put to use, there is no need to have the upper end of a greater diameter than the breadth of the wall-plate, which we may set down at 9 inches. If we make the height of the shed 14 feet (it may in sheltered positions be as high as 18 if we choose), the diameter of the post at the surface of the ground will seldom be less than 12 inches. It will usually, we daresay, be nearer 15. This is a post which, if secured in the ground as before directed, will give back the cart or other farm implement that collides with it as good as it gets, more than likely with interest too. A lighter post will serve the turn—one of 6 inches diameter at the top, for instance. But where trees of the kind are available, it is well to err on the safe side. It is only, of course, on the large estate that they could be looked for in the present connection. Were they to be had in the market alone, something else would be substituted. They could not very well be turned to better account on the estate than in the manner we are indicating—taking part in the improvement of the several homesteads therein by affording storage room for hay and sheaves.

There are not many Scottish estates, however, where sweet chestnut is grown in much abundance. In England we find it more plentiful; but there it is largely turned to account for fencing purposes, for which it appears to be well adapted, at least for the class of fencing we see it taking part in—the substantial and strong split post-and-rail fence.

But the majority of Scottish estates bear abundance of the various firs and pine, and some of them larch. The last named is the best of all for our purpose, but failing it the others can be made to do well enough. These different woods do not depend so much as the oak on the accumulation of mineral salts in their fibres for promoting their durability. The resinous matters that are characteristic of this class of wood seem to be its peculiar safeguard in this respect. Larch has the closest resemblance of them all to oak in the matter of durability. It, too, shows a clearer distinction between old and newly formed wood—more, however, in colour than in durability, for well-grown larch-wood is good to the rim. Scots pine, or "Scotch fir" as it is popularly termed, shows a little of the same character. The others betray little or no difference in the nature of the wood revealed in cross-section of the trunk.

If we take spruce fir as being the poorest of the woods adaptable for shed posts, there is nothing to prevent its serving the purpose, provided ordinary precautions are taken to give it a helping hand in resisting the weather. If we take care to see that the trees are well grown, and as straight and clean (*i.e.*, free of branches) as possible, there need be little else observed. In the well-grown tree the wood, as a cross-section will show, has accumulated in thinnish regular bands, with the matter composing the same closely packed together. There is perhaps less resin in this wood than in the others we have grouped along with it; still, if given a fair chance, it is competent to hold its own for a comparatively long time—for a long time as sheds go at anyrate. The post should be seasoned. It should have lain for a year at least clear of the ground, not of necessity under cover. If open to the weather it should be turned now and again. By leaving the post in its bark there will be less likelihood of the outer skin of the wood becoming cracked longitudinally. The bark can be more readily separated from the wood at the time the tree is felled, but the extra trouble involved in barking the seasoned post repays us in the way we have indicated.

A well-grown, straight, clean, and seasoned post of spruce, with its end 2½ feet in the ground, embedded in and surrounded by a thick collar of Portland cement concrete carried up clear of the surface-soil, should be able to stand unaffected by weather for a considerable number of years. No rain can penetrate the upper end. And it can be hindered from entering at other parts. Should the natural skin have been rendered of little effect, or should cracks be numerous therein, or the tree have had many side branches and the post in consequence be studded with knots both old and new, the armour of the post will be weak. But this can be strengthened by the application of either tar or paint, or some suitable equivalent.

If spruce can be relied on to support the shed, so may silver fir. Much more so may Scots pine, and to a greater degree larch. There are some of the woods we have mentioned on the most of estates, and good managers need hardly be ever at a loss for suitable material for shed posts without having to go far afield for them. It serves a bad end, however, to stick up posts that are unseasoned and otherwise unsuitable, simply for the lack of a little trouble to make them so.

Failing to obtain the necessary posts from the estate plantations, there is nothing for it, if wood is still to be the material, but to procure them from the timber merchant. Foreign-grown wood will then most likely have to be selected, either pine or fir. Pitch pine is very suitable and easily obtained. But white pine will do well enough, seeing we would do by the foreign as

with the home-grown wood. Round posts would be out of the question in the majority of cases in which imported timber was selected. Very few timber merchants can offer their customers foreign tree-trunks in their natural condition of a size suitable to be used as posts. Were there a large enough demand for them, they would no doubt be as quickly forthcoming as telegraph-posts; but for a merchant to import a cargo, or other reasonable quantity in accordance with shipping interests, on the chance of a small and intermittent demand for them, would not be indicative of the possession of much foresight on his part.

Trees of the same class that is put to use as telegraph-posts would answer admirably for sheds at the homestead — the heavier ones for the wider and higher sheds, and the lighter ones for smaller erections. They would last much longer as part of the fabric of a shed, such as we are describing, than they do out in the open carrying the wires. There they have no shelter whatever. Sun, rain, and wind, and heat and cold, in quick alternation, have them entirely at their mercy. As part of the shed they would escape a great deal of this. The wind does not blow nor the rain beat upon all sides of the shed at one and the same time. Neither does the sun fully affect all parts of the shed simultaneously.

We have said nothing about dressing the shed posts with some preservative previous to using them. Creosote is used for telegraph-poles, but for shed posts it is not so suitable. When creosote is made use of the wood has to be steeped in it, or otherwise subjected to it as a single piece. It is not practicable to creosote one part of a tree-trunk or of a plank and leave the remainder unaffected thereby—the whole piece must be laid in the stuff. This is not required in the instance of a piece of wood to be situated as the shed post usually is—with, we repeat, the post in the ground encased in concrete, the top end out of the way of rain, and but little of the rest of it exposed for long at a time to the ravages of weather. Creosoting would be here a needless expense. In those cases where the skin of the post is, for the reasons above stated, somewhat ineffective, the post will repay the application of some protective coating. It could not be creosote, however. The wood has to be taken to it, not it to the wood. Applying it by means of a brush is of no use. But there are other good preservatives that, like paint or tar, can be applied in this way. If we have sound-grown and well-seasoned wood to start with, no matter of what kind, that is the best safeguard against premature decay. Artificial safeguards other than those implied in the method of procedure we are recommending are, we consider, unnecessary.

We are speaking just now of the round post—of the trunk of the tree taken in its natural shape to do service in supporting the shed. Turning to the post sawn out of trees imported from abroad, the faces of which are in the rough condition imparted by the saw, it is advisable to dress it when fixed in position with some preservative dressing. It is almost worth the little extra time involved to plane the post of this kind smooth and slightly chamfer the corners. The rain will run quicker down the smooth wood, which is always some advantage. The post will look a little better too, and it will not be so apt to have its corners knocked off.

Objections to Slate Roofs.

The posts having been decided upon, the nature of the roof next falls to be taken up. The slate-covered roof is in our opinion rather out of court in connection with the sheds under discussion. Their first cost is alone enough to render them prohibitive. Besides, the framework necessary for a covering of the kind interferes, as we have already demonstrated, with the storing of the stuff under the same. The many ties required are not only in the way when the shed is being filled, but they are, as we have seen, liable to be bent and fractured by the hay or corn as it settles down thereafter. A slate roof is no doubt the most durable we can have; but something of a more temporary nature is quite excusable in this connection.

Galvanised Corrugated Iron Roof Sheets.

Galvanised corrugated sheet-iron is now the favourite roofing material. The puckering or corrugation of the sheets adds strength thereto, and the coating of spelter or zinc which is bestowed thereon during the process of galvanising renders the iron weather-proof. Any clean surface of iron will rust at once on exposure to damp air. So long as the iron and the air keep dry there will be no change. There is no chance, however, of this continuing for any length of time in our atmosphere. But so long as the thin film of zinc, due to galvanising, remains intact, the oxygen in the air will be kept out of contact with the iron. It is air and moisture, we saw, that eat away the shed post if left unprotected in the ground. We check this action by means of the concrete collar so often referred to above. Iron has smaller power of resistance against the combined action of moisture and air (or rather the oxygen contained in the latter, for this is the busybody that works the harm) than wood has. But thoroughly encased all over in a light fitting coat of zinc (on which the two have little effect),

the iron is thus rendered even more invulnerable than the post set in concrete. Wet gets at the part of the post above ground, but while the covering of zinc holds good none can reach the iron underneath. A roofing sheet of iron, if exposed to the atmosphere without first having been galvanised, will be pitted with rust in a few weeks, while a galvanised sheet of the same sort will continue serviceable for many years. "Why not use zinc at once?" a novice may ask. It is too dear for one thing, and for another not so tough and elastic as iron. The latter in sheet form needs less propping up and fewer bearing points than a similar sized one of the other metal would. The zinc is so brittle that it would almost require to be laid on boards as we do with slates, while the iron sheet, as we shall see, can be safely left to bridge over a considerable space.

The corrugation of the iron sheet adds, we repeat, to the inherent strength of the article, and that considerably. We cannot remember coming across the results of any experiments to test how far this goes. It must, we feel sure, however, go much further than what doubling the thickness of a flat sheet will do. A flat sheet of a certain weight will not be nearly so strong as one of the same weight but corrugated in the usual manner.

Other materials are pushed in opposition to corrugated iron for shed roofs, but none that we are acquainted with comes up so well to the requirements necessary in a material which has to occupy that rather trying position. Willesden paper, for instance, will resist rain and snow for long if in a comparatively sheltered and protected situation. Such a substance, however, can hardly be expected to cope successfully with the buffetings that the hay or corn shed annually comes in for, not to mention the other trying forms of incidental tear and wear peculiar to the lot of farm buildings. And as regards the others, nearly all of them so many modifications of the common felt-and-tar covering, similar objections apply. Some of them may be a little cheaper to start with, but the subsequent attention they need is a strong point against them. The frequent coats of tar or paint, or other form of preservative dressing, that most of them need, are often overlooked. On these dressings, bestowed at regular intervals, the life of the roof depends. If done fitfully only, and then with little care, the end of a roof of this description comes very quickly. And even the best of them require, like zinc, much more support, and consequently a more expensive framework, than the iron sheets do.

But the corrugated iron roof, once properly erected, will, provided no accidents come its way, serve its time without further attention. The iron will remain sound so long as the zinc holds good, and in ordinary situations, with good sheets

of their kind to start with, that may easily be for a quarter of a century, or it may be for longer. And the covering as a whole, if it does not derive very much stability from its own weight, is capable of being easily bound together in such a manner that it will not readily succumb to wind pressure.

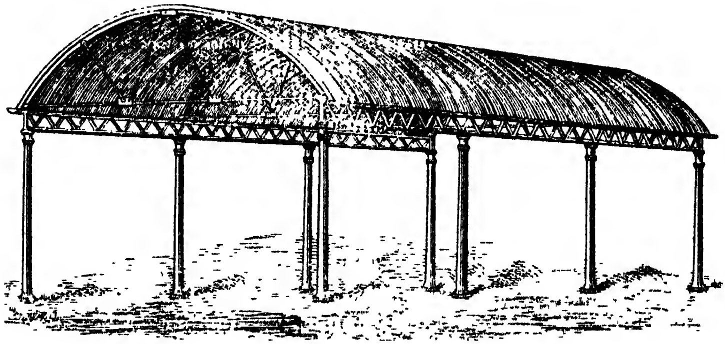

Fig. 26.—*Shed with circular roof.*

The circular or curved form of roof, as shown in fig. 26, is, we think, preferable to the angular or pitched roof, figs. 27 and 28. It is simpler, having fewer parts connected therewith. The angular roof requires something considerable by way of a

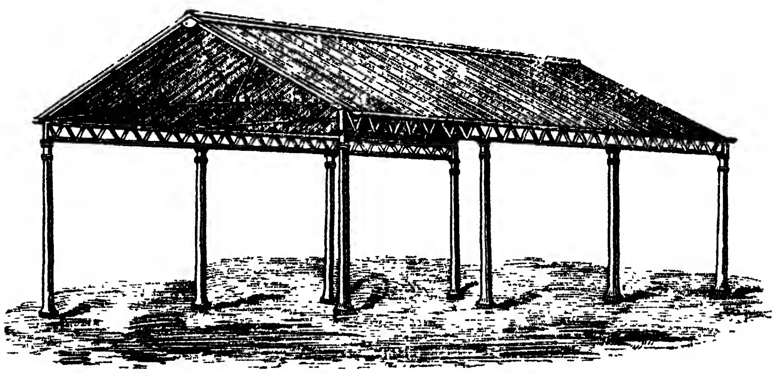

Fig. 27.—*Shed with angular roof.*

skeleton framework for the attachment of the sheets thereto. So, of course, does the other, but less suffices. Spans of 16 feet or so, as in fig. 41, may do without aid of this kind. Provided the posts and wall-plate are rigid enough, the circular covering bridging the space quoted will be sufficiently stiff in itself to do

without further support. In spans of greater width the introduction of trusses or principal rafters, with purlins or cross-pieces stretching from one to the other, as in figs. 33 and 34, becomes necessary in order to give stiffness to the circular covering. But the pitched roof, which requires supports of that kind to start with, needs to have these enlarged for increased spans at a greater ratio than takes place with the curved roof.

Figs. 26 and 27 represent sheaf-sheds manufactured to order by Messrs P. & R. Fleming, Glasgow. The former is 96 feet long by 30 feet wide by 17 feet to eaves, on fourteen columns prepared for stone or concrete. The principals are formed of T- and L-iron; the gables are clad to eaves, and the roof-sheets are of No. 20. Eaves-gutters and down-pipes are provided. The latter is of similar construction—80 feet long, 30 feet wide, and 17 feet to eaves, on twelve columns. These are noble specimens of their kind, but the cost is high.

The curved sheets are the dearer, but the more complicated

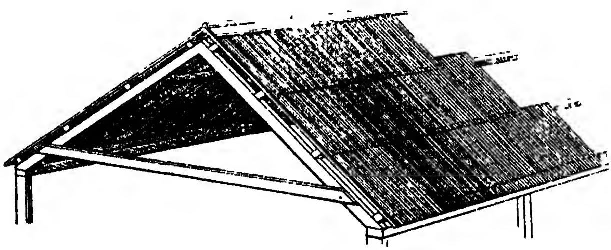

Fig. 28.—*Angular or pitched roof.*

framework of the pitched roof counterbalances this initial advantage of the straight sheet. What is more to the point, however, is the fact that the shed with the curved roof is the more commodious and the easier packed of the two in question. The round-roofed shed, as a glance at the last three figures will show, can be more easily filled than the ridge-roofed one. And the figures make plain, without more ado, that the former is also capable of holding more stuff. One can get better into the sides of the roof so as to pack the stuff tight down, and can recede more gradually towards the apex or bisecting point of the roof. If, further, it is perfectly possible to dispense with cross-ties in the circular-roofed shed, which it is, and which we know cannot be done with a pitched roof, this of itself is sufficient to establish the practical superiority of the one over the other. Not only does the intervention of these cross-ties often, in the manner already indicated, lead up to the harm of the shed, but they seriously hamper the working of the horse-power fork when it is called into aid in filling up the shed.

The Shed of Iron and Wood.

The manufacturers of sheds all of iron are, as we shall see, beginning to realise the necessity of doing away with cross-ties altogether. But dealing first with our composite shed,—the one with posts and wall-plate wholly of wood and the covering of corrugated iron,—it is possible, as we have said, to dispense with both truss and tie when the spans are under a certain width. And beyond that point it is quite practicable to adopt a truss that requires no cross-tie to counteract its tendency to spread. Up to, say, 18 feet of span an efficient truss is afforded, as in fig. 17, by T-angle wrought-iron bent to the form to be taken by the roof. The flatter such a thing is the readier will it spread, therefore it is advisable to keep the crown of the circle pretty well up. By doing so we increase the capacity of the shed as well as give greater stability to the roof. From 20 to 24 feet, the latter being as wide a span as we need provide for in this connection, the same kind of truss strengthened a little at the centre is equally efficient. It is needful, of course, to fit each end of the truss with a sort of flange or shoe with which to secure it to the wall-plate. What purlins are required can be bolted to the truss, and in these and the wall-plates we have together an effective framework to which the sheets may be firmly attached. We then have a shed free of obstructions in the way of stays and ties, whichever way we like to take it, from end to end, side to side, or from roof-cover to floor.

We are as much at liberty to make free use of the space under the canopy as of the floor area itself: an aerial railway in the shape of a carrier for a travelling-fork or hay-lifter will often in action have no more obstructions than carts are likely to have in delivering their loads at ground-level. The fork-carrier can be attached to the trusses, but its use necessitates, of course, a somewhat stronger or stouter truss than will serve for the support of the roof alone. If, however, we allow for a strong article to begin with (there must, of course, be a considerable reserve or margin of strength in every building), it will no doubt be able to withstand the additional strain that the use of the fork will bring to play upon it.

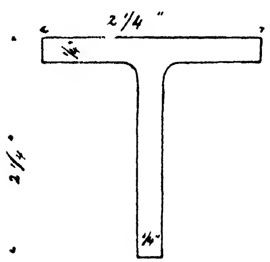

Fig 29.—*Section of angle-iron roof girder.*

Wrought-iron of a section such as fig. 29 indicates is of quite sufficient strength for a truss for the smaller span. Bent into proper shape, the iron bar will do without further aid. The same section of bar will do for the wider span also if stiffened

something after the manner shown in fig. 30. This truss shows a bar of T-iron let in under the top of the arch of the roof, where, as can easily be seen, it must add considerably to the strength and stiffness of the latter. The two are

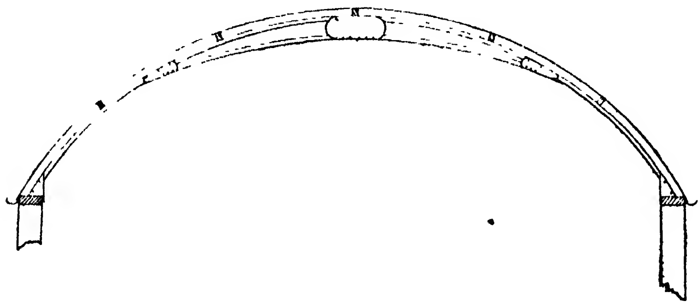

Fig. 30.—*Section of angle-iron roof-frame.*

fixed together at the crown by means of an oval-shaped fish-plate, and by a similar contrivance at each extremity of the bow.

Fig. 31 shows the kind of shoe that is attached to either end of the truss. It has a sort of heel *a* that butts against the inner side of the wall-plate and keeps it from straddling. If the truss yields in that way the wall-plate must go first. With shoes of this kind attached thereto we can fasten the trusses very firmly to the wall-plates. The latter we can secure as firmly as need be to the heads of the posts. With these several parts made one as it were, and the posts fixed firmly in the ground as already directed, we have a skeleton structure that cannot readily be disjointed or torn asunder by the wind. The roof covering may possibly be forced off—if, for instance, the purlins are put on carelessly or the sheets are not of a sufficient thickness. There is no reason, however, why either eventuality should arise. Purlins are quite easy of attachment to the iron bar truss.

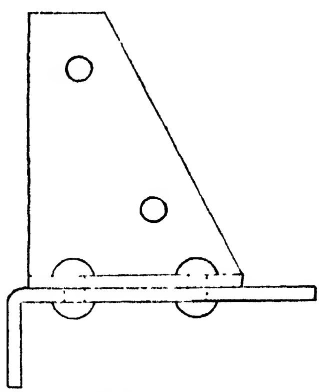

Fig. 31.—*Shoe for securing foot of girder to wall-plate.*

Fig. 32 shows how this can be done in a perfectly secure manner. A little ledge *a* fastened to the back or top of the T-bar affords a resting-place for the purlin *b*, which is further

fastened to the bar with bolt and nut. The ledge is needed only on the side of the roof—the part where the purlin would slide down the truss. It is not required for the purlin that bears along on the top line of the trusses. There it has no inclination to slide to one side or the other. It is well worth its cost, however, on the sides of the truss, because it goes to take the cross-strain, due to the sliding tendency of the purlins, off the bolts that keep the two together. Secured in this way, there is little likelihood of the purlins losing hold of the trusses. And when the sheets are fixed to such firm purlins and to the wall-plates, the covering of sheets will be unable to move either out of position. If it comes to it that the sheets must give way, they must go by themselves. They must tear away from the bolts and nails, leaving the framework intact.

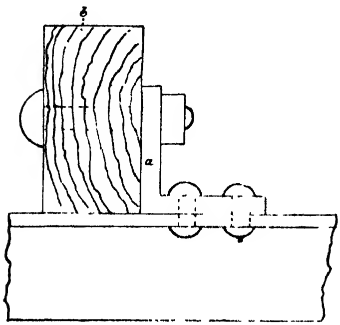

Fig. 32.—*Bracket for attaching purlin to girder.*

Fig. 33 gives the elevation of a truss of this kind in position. The wall-plates are 9 inches by 3 inches, and the purlins only 3 inches by 2 inches. The latter, it will be seen, are very small in scantling, considering the position they occupy. But, after all, they have not a great deal to do. They are there more for the purpose of stiffening and holding down the roof-cover than anything else. They have little or no weight to bear. Their principal duty is to help the curve to maintain its figure, by giving it backbone as it were. Five purlins 3 inches by 2 inches are fitted up. The curve or arc from eave to eave measures about 27 feet. Three sheets—two of them 9 feet long and one 10—will do for this. They will allow sufficient projection over the faces of the wall-plates, and plenty of overlap at the junctions of the sheets.

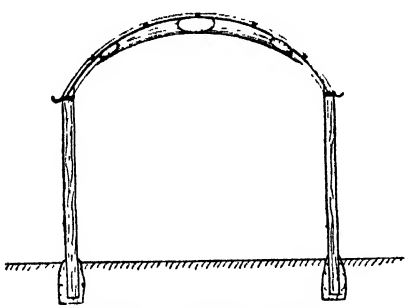

Fig. 33.—*Section of shed.*

In fig. 34 we give a side elevation of the shed, part of it showing the framework of the roof, and part with the sheets

put on. The short sheets are kept for the side and the long one for the top. A set of purlins are placed in such a position that they come in at the junction of the sheets, thus enabling the latter to be fastened together and to the purlin at one and the same time.

We suggested to place the posts 12 feet apart, a width which allows ample room for the ingress and egress of rick-lifters, carts, and so on. Over the heads of each pair of posts is the correct position for placing the ends of the separated trusses, and 12 feet apart is not too wide for the spacing of these where, in the case of corrugated iron, the roof-cover is comparatively so light. It may necessitate slightly heavier purlins than a closer ranking of the trusses requires. Twelve feet is a considerable space for a 9-inch by 3-inch wall-plate to bridge over. But the stay-struts we show in the elevation make matters right in this respect. They are of T-angle iron too, like the trusses, and while they serve to support the wall-plate they at same time help to bind it and the posts tighter together. Each is fastened to post and wall-plate with a stout screw-bolt at either extremity, the one at the post passing through it and securing the bracket at either side thereof.

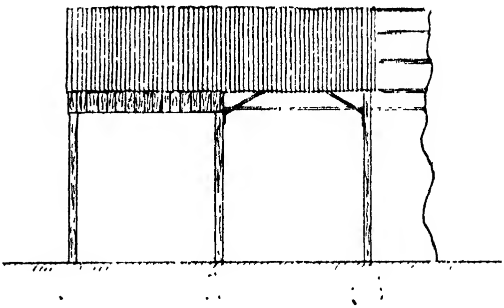

Fig. 34.—*Side elevation of shed.*

The shed we have just been illustrating (figs. 33 and 34) has posts of foreign-grown wood. They are rectangular, it will be noticed. Home- or estate-grown posts, as above referred to, were not available where it was erected. The posts are of pitch pine, 9 inches by 5 inches in cross-section. The shed stands 15 feet from surface of ground to under side of wall-plate, is 22 feet wide and 60 feet in length. Both ends and one side are boarded from top to bottom, the remaining side being lined down 2 feet from the wall-plate the whole way along.

The closing in of the shed is not a universal custom, but in situations liable to frequent storms it becomes a necessity to have part of it so treated. It is common throughout the south-west of Scotland, especially in Ayrshire and Renfrewshire. Thereabouts it is usual to see the hay-shed completely boarded in, access thereto being obtained by means of one or more large sliding-doors. The farmer is usually content, however, if he manages to get the stormy-side and end protected in

this way; and it is a great protection thus to prevent the rush of high wind through the shed. Much hay is thereby saved which would otherwise be borne away by the blast. Only little at a time may go in this manner; but the times of going, from the "hint o' hairst" till the end of April, are frequent. More is blown out of the arms of the stock-attendants than from the shed itself.

When, however, the shed is protected from the windy "airt" little hay is lost in either way. The attendants are at liberty to get proper hold of their burden without the stuff being blown about them and away on the wind as they loosen it from the bulk; and they, too, are sheltered from the wind, so long at any rate as they are in lee of the shed; and if matters have been well arranged, the shed should be so near to the animals' quarters that very little distance between shed and byre, or shed and stable, has to be covered. The man with the completely enclosed shed has the further satisfaction of being able to keep poultry and stray horses and cattle out of the shed, and to shut out tramps therefrom,—benefits worth having, no doubt, yet by no means indispensable. But whatever lining is added to the sheds, it is essential that the gable-ends down to the bottom of the wall-plate (and in many cases beneficial that the sides for 12 inches or 18 inches below that) should be boarded. The sheaves cannot very well be packed tight enough at the gable-heads to turn rain; and as the sheaves settle in the shed, not lined down as we suggest, a slack place shows which may admit rain, and is a constant temptation to hens in search of a nesting-place. And no shed can be considered complete that is unprovided with eaves-gutters, or rhones and drop-pipes or conductors to lead off the water from the same. Quite enough rain is likely to beat upon the shed without the drippings of the eaves being allowed to run down the sides of the filled sheds.

Specification of Shed.

Here is the specification of such a shed as we have been discussing: The shed to be 60 feet long, 22 feet wide, and 15 feet high from surface of ground to under side of wall-plate. The roof to be arched and the crown thereof to stand 6 feet 9 inches above upper side of wall-plate. The side posts to be of pitch-pine 9 inches by 5 inches, the end two (one in centre of each gable) 9 inches by 3 inches, and to be set 3 feet deep in the ground, embedded in and surrounded by good Portland cement concrete 6 inches deep in the bottom of the hole and 9 inches thick round the sides. The concrete to be well rammed into the hole, and the top of the collar to be carried up clear of the ground a little and smoothly bevelled off with cement and sand

in order to prevent water lodging against the foot of the post. The posts to be fixed up 12 feet apart from centre to centre. Wall-plates 9 inches by 3 inches to be set on the tops of these along sides and across ends, firmly spiked or screwed thereto; and in addition the wall-plate to be further supported by means of T wrought-iron brackets or struts $2\frac{1}{4}$ inches by $2\frac{1}{4}$ inches and $\frac{1}{4}$ inch thick and $4\frac{1}{2}$ feet long, firmly secured with bolts and nuts to sides of posts and bottom of wall-plates—one end of the bracket 3 feet along wall-plate and the other the same distance down the post.

Six $2\frac{1}{4}$-inch by $2\frac{1}{4}$-inch by $\frac{1}{4}$-inch T wrought-iron girders, each with a circle truss of the same iron in crown, screwed to girder with $\frac{1}{4}$-inch steel fish-plates as shown on plan. The ends of the girders to be fitted with shoes of $\frac{5}{8}$-inch wrought-iron for attachment to wall-plate. And on the outer circle brackets of $\frac{5}{8}$-inch wrought-iron, as drawn on the figures, to be fixed in position for the purpose of keeping the purlins secure, the latter to be bolted to the brackets before the sheets are attached. Galvanised wrought-iron rhone-hooks to be fastened to the wall-plates 3 feet apart in readiness for rhones after the roof-sheets have been fitted together.

Five purlins 3 inches by 2 inches to be fixed to the girders by means of the brackets above mentioned. The corrugated galvanised iron sheets to be attached to these and the wall-plates at each side with galvanised nails and washers. The sheets to be 20 B.W.G. (Birmingham wire gauge).

Cast-iron beaded $4\frac{1}{2}$-inch rhones to be laid on the rhone-hooks and be fastened thereto with copper wire. These to be connected to 3-inch cast-iron conductors or drop-pipes with suitable swan-necks at top and shoes at foot—one conductor at each corner of shed, and the rhones to be inclined accordingly.

One side and both ends of the shed to be boarded close down to the ground, and the remaining side 18 inches down from wall-plate. For this purpose three rows of runners, each 4 inches by 3 inches, to be morticed to posts flush with their outer faces. The bottom runner to be 3 or 4 inches from the surface of the ground, and the others equally spaced between it and the wall-plate. And similar provision for attachment of the boards to be made at each rounded gable-end. Along the side to be left open a runner similar to the above to be carried along at 17 inches from the wall-plate. The boarding to be used in lining these parts to be ordinary 9-inch by $\frac{5}{8}$-inch sarking-boards. These to be firmly nailed to the runners $\frac{1}{4}$ inch apart. In each gable, and well up in the crown, a hinged manhole with fastener to be formed in the boarding.

Cost of Shed.

This makes a capacious, a strong, and a durable hay-shed, but necessarily rather expensive. It is well worth the money, however, to any one who likes a good and substantial job. At present prices its cost may be put at the following figures:—

Excavating holes and setting up posts (inclusive of concrete) and putting together the timber framework . .	£7	10	0
Cost of timber	16	0	0
Cost of roof, inclusive of rhones, &c., and its erection .	60	0	0
Total . .	£83	10	0

Say £85, which is equivalent to 28s. 4d. per running foot of shed.

Specification of a less substantial Shed.

Here is the specification of one of a less substantial character: The shed to be 60 feet long, 22 feet wide, and 15 feet high from ground to under side of wall-plate.

The posts to be of pitch pine 9 inches by 5 inches, sunk 3 feet in the ground, embedded in and surrounded by good Portland cement concrete. The concrete to be 6 inches at bottom and not less than 9 inches round the sides, and the collar to be carried up clear of the ground with cement mortar smoothed and bevelled off all round. The side posts to be 12 feet apart from centre to centre, and one 9 inches by 3 inches to be set up between the corner posts of each gable. Diagonal stays 6½ inches by 2½ inches, stretching from ground to wall-plate, to be between each pair of posts, except at doorway, both at sides and ends.

The wall-plate to be 9 inches by 3 inches, and be carried across ends as well as along sides, and be firmly secured down to the heads of the posts by means of 6-inch wood screws.

The shed to be boarded in all round excepting at doorway; and for that purpose three rows of runners, 4 inches by 2 inches checked flush with outer face of posts and fastened to the stays, to be carried along sides and across ends of shed—the bottom runner 3 inches above ground-level, and the other two spaced between it and wall-plate; and each gable-head to have a similar runner placed half-way up. Ordinary 9-inch by ⅝-inch sarking-boards to be firmly nailed to these runners ¼ inch apart, close up to eaves and gable projections, and nearly touching the ground.

The gate or doorway to be simply the space between a pair of posts and be 12 feet 6 inches in height, the part above being boarded as above. The door, 12 feet by 12 feet 6 inches, to

be framed and sparred, to be in halves, and hung on wheels sliding right and left on an iron rod secured to a wooden runner.

The roof to be pitched or ridge-shaped. The framework to consist of principal rafters placed over each pair of posts. The couples of the rafters to be 7 inches by 3 inches, and the ties 9 inches by 3 inches, with short side or hanging pieces 6 inches by 2 inches at 5 feet in from each side. A small couple 6 inches by 2 inches, with ties of the same, to be between each principal. Four rows of purlins 3 inches by 2 inches to be fixed up on each side of the roof, the upper one 3 inches from ridge, and the other three equally spaced between it and the wall-plate.

The roof-sheets and ridge-piece to be of 22 B.W.G. galvanised corrugated iron all securely fastened with galvanised nails and screws and washers; the ridge finished with a proper capping piece of similar material.

Cast-iron beaded $4\frac{1}{2}$-inch rhones fitted in wrought-iron galvanised hooks to be fixed to eaves with $2\frac{1}{2}$-inch conductors with swan-necks, shoes, and proper holdfasts at each corner of the shed.

Cost.

This shed can be erected at a cost of from £60 to £65, exclusive, of course, of the cartage of materials; or say a little over 21s. a running foot of the erection. Whatever boarding was dispensed with would effect a saving, but hardly so much as one would expect. Tenpence a square yard easily covers this item of the shed. The shed, efficient enough in other respects, possesses the defects, or rather the disadvantages, previously pointed out that accompany the pitched roof, and the ties from side to side which characterise it. There is, however, many a less suitable and more inconvenient shed than this throughout the country, notwithstanding how far short in many respects it comes of the preceding one.

The two specifications imply the use of imported wood for all parts of the sheds. As we hinted before, few of the estates that might be self-supporting in this respect actually are so. We have already allowed the existence of the difficulties that stand in the way of the estate yielding suitable wood for the object we have in view—difficulties and drawbacks which render it cheaper for the proprietor to buy wood from abroad than to turn to account what grows on his own land. But while this applies to converted timber—timber sawn up into scantlings and boards—it leaves little excuse for his neglecting to make use of the trunks of trees in their natural form for such purposes as posts for sheds. Not much skill and no

power-driven mechanical appliances are called for in an instance of this kind. And where they are supplied we are ensured at any rate of a more picturesque, if not a more stable, structure.

The Shed all of Iron.

Turning now to the shed built entirely of iron instead of the composite shed we have been discussing, rods, bars, and girders take the place of wall-plate, purlin, and runner, and corrugated-iron sheets that of boards. We have expressed our preference for the composite shed before the one all of iron, more, as we said, on sentimental grounds than for any other reason. The composite shed can be put together by local tradesmen—by the country joiner and the jobbing blacksmith—when estate hands are not available. But the iron shed is put up to the sight of the manufacturer of such erections by men on piecework, strangers to the country-side, sent out from the works. It is, of course, good business to get the shed put up at the cheapest rate. But it is sometimes wise economy to spend money near home, even if it does not quite go so far as in town. We are, it must be understood, assuming that the proprietor is undertaking the principal share of the shed-building, if not defraying the full cost thereof. Where the farmer shouldefeté e responsibility it is a different matter altogether. He is nound trosed to look far ahead of his individual wants in the busnd won hand.

The composite shed, while capable dTherection by means of local skill, can readily be repaired by the same. This is hardly practicable, however, in the case of the iron construction. We have to seek men where it came from to put it to rights once the hand of time begins to fall heavily upon it, or accident has come its way.

The sheets forming the roof are of course as much out of harm's way as those which complete the composite shed. But the remaining parts of the iron shed are destitute of such protection as we bestow on the sheets. The manufacturer usually endows them with a coat of paint before sending them from the works. This, no doubt, is better than nothing, but it is not very permanent in effect. What remains of it after the parts have undergone the rubs and knocks incidental to transit is inconsiderable. Were it backed up with another good coat after the erection was completed matters would not be so bad. But prices have to be so keenly cut that manufacturers cannot take this into consideration. And once the shed is up the purchaser—whether laird or farmer—never thinks it a necessary duty on his part to set about painting the construction. The bad looks may be the worst that befalls the skeleton of the shed, for under the most adverse circumstances

it may be a long time before the vital parts of the framework itself get eaten into by rust. But where the galvanised sheets are suffered to remain in contact with rusty iron decay soon sets in at these points of contact, and once the roof has grown leaky the best days of the shed are past.

Figs. 35, 36, and 37 represent a modern iron hay-shed that is very highly spoken of and rightly so. It is manufactured by Messrs A. and J. Main & Co., Ltd., Glasgow, and in it they have certainly produced an article which one would think can

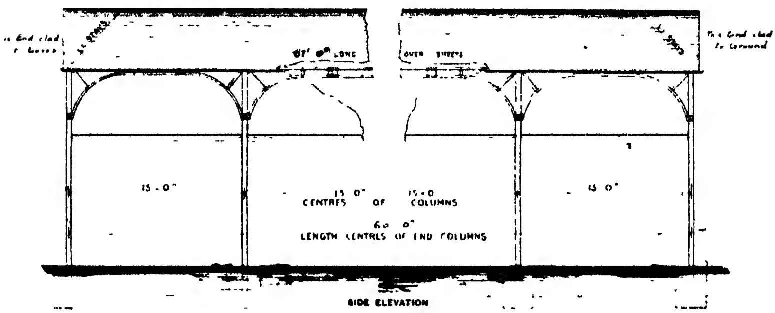

Fig. 35.

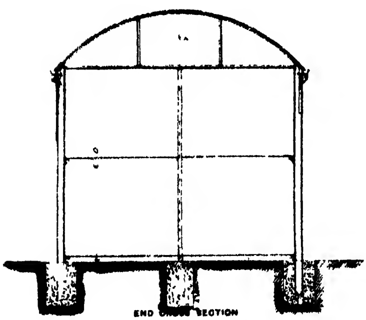

Fig. 36.

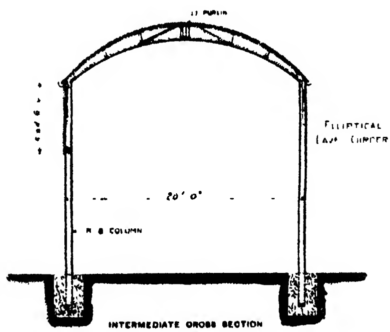

Fig. 37.

Figs. 35, 36, and 37.—*Messrs Main's all-iron sheds.*

be little further evolved on the lines of economy. It seems to contain the very minimum of material consistent with the due amount of strength. It is roomy, however, and free of all inside obstructions. In order to avoid the latter the makers have introduced a truss girder or principal rafter which interferes little or not at all with the head-room, while it is strong enough to admit the use of a horse-fork. The use of the eaves-girders for support of the wall-plates allows a wide space between columns

—15 feet in this instance. And the shed may be clad down as required, or inclosed in any way thought fit. The makers always, we expect, inclose the gable-heads down to eaves-level, but they seem to think it the correct thing, where lining is not stipulated, to leave the eaves without any protection of this kind, as we recommended above when discussing the composite shed. This provision, if not actually a necessity, is at any rate a useful adjunct. And it is even more called for in the shed we are dealing with than in the other, on account of the arch of the roof being lower. The crown of the roof of the composite shed is 6 feet 9 inches above the level of the wall-plate, but only about 4 feet in the case of the Messrs Main's sheds. The shed with the higher arched roof allows of firmer packing at the eaves than in the other. A man cannot get so close into the sides of the flatter roofed shed when it is nearly full as in the other. Raising the arch means additional expense, however, and in the iron shed we are exemplifying every detail is economised to the utmost.

The column, 6 inches by 3 inches in this instance, does really give one the impression that this detail is scrimply dealt with. It is of rolled steel, however, and therefore much stronger than it looks.

Another item of the shed speaks to close cutting down. We refer to the weight of the corrugated-iron sheets that are used. When first we began having to do with galvanised-iron sheets, No. 18 was reckoned the correct gauge for a good job. Then No. 20 came to be thought sufficient, and it is still the gauge recognised in the specifications of the Board of Agriculture in connection with estate buildings on which it authorises the advancement of loans for the erection of the same. Now, however, No. 22 is most generally used; and in sheltered localities, mostly in England, No. 24 is employed. After all, however, it is the coating of zinc, not the iron itself, that has to be looked to as the medium which governs the protective qualities of a roof of the kind. Still a certain amount of stiffness in the sheets is requisite in order that the roof may be rigid enough. If the cover has too much come and go—if strong winds can bend it out and in, even a very little—it is apt, when under the influence of a gale, to be torn away from the bolts. The thinner the sheets are the less resistance they will of course offer to the force of the wind.

There is some room for misunderstanding over this matter of the gauge of corrugated-iron sheets. The trade—that is, the makers and the wholesale dealers of these sheets—base their measurement on the iron before it has undergone the process of galvanising. But we suspect this rule is not always observed by the ironmonger and the tradesman who come between the

former two and the public in general. Not infrequently do these middlemen, we are afraid, base their standard of measurement upon the galvanised article. Thus it may often come about that we are called to pay for a certain gauge while we actually receive one of less value. If, however, we bring in weight as a factor in the bargain, there is little chance of any misunderstanding on the head of gauges. A 6 feet by 2 feet sheet of No. 20 galvanised-iron weighs 24½ lb., one of No. 22 20½ lb., and one of No. 24 16¼ lb. The galvanising adds about 10 per cent to the original weight of the sheet. Few men possess a measure of these gauges, which is of little consequence, because they do not see the sheets in their ungalvanised state, but a weighing apparatus is rarely out of reach at country places. With the aid of the latter it is quite easy, therefore, to set one's mind at rest as regards the thickness of any iron sheets that are about to be used at the farm. The sheets are all one breadth, hence it is easy to compare different lengths with those just quoted.

While the makers of this shed maintain they have never received intimation that roofs have been blown off, they admit instances where in the past sheds themselves have been overturned. To lessen the risk of this the makers now attach a small shoe to the base of the column to hinder its withdrawal from the block. As shown in the figures, it is a trifling affair; but so long as it proves effective it is all that is wanted. A good long stout bolt, put through the column as in fig. 38, would answer better, we think, and be cheaper.

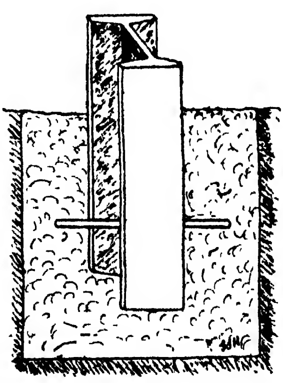

Fig. 38.—*Method of fixing end of angle-iron or steel pillar.*

So carefully has every detail of this shed been cut down with a view to exercising the strictest economy that it can be erected complete for about £1 a running foot of the actual shed space, varying more or less in accordance with the amount of sheeting at ends and sides—that is, of course, if the farm is within reasonable distance of Glasgow as regards railway carriage. The purchaser of the shed is supposed to excavate the holes for the columns, and supply and fill in the concrete. The remainder of the work, including its fitting up of eaves-gutters and conductors, is executed by the manufacturer of the shed.

Sheds for Corn-Sheaves.

So much, then, for the hay-shed. If similar shelter is to be found for the corn crop of the farm, something of a cheaper description will have to be forthcoming, we are afraid. But hitherto manufacturers have not sought to introduce anything suitable for the storage of sheaves of corn. Shedding to cost £1 a-foot is too expensive a luxury in this connection. Could something of a less permanent nature be devised, or rather something that a tenant could take away when he changed his holding, a demand for it would speedily arise. The only thing of the kind we have come across is a covering of corrugated-iron sheets, resting right upon the top of the stack of hay or straw. This, however, comes more under the head of thatching material than actual shedding, and it does not appear to have caught on to the popular taste. What is really wanted is a form of shed which, failing the erection of such buildings being undertaken by the proprietor, is feasible to be set about by the tenant himself—a sort of erection he can put up without fear of its confiscation on account of being built on another man's property should misunderstandings between parties happen to arise. But nothing of this description is yet available. Nor is there anything in the market to meet those cases in which either the proprietor volunteers to take the matter in hand himself or proprietor and tenant combine in a suitably proportionate way to see the business through. Even to meet these cases the £1-a-foot shed would mean a too heavy loading of capital.

It is open, of course, to the proprietor to borrow money through the Board of Agriculture, the loan being repayable in a series of instalments embracing both capital and interest. But the Board calls for extra good work, or at any rate materials, in erections it provides money for. No. 20 corrugated-iron is the lightest stuff of the kind they permit, and then there are sundry expenses to be reckoned with.

In a case where the estate is able to supply an abundance of suitable posts, a cheap yet efficient range of shedding can be erected by taking advantage of the fact that up to a certain width of span it is practicable to make use of a curved roof of corrugated sheets devoid of rafters or purlins of any kind. Turning to fig. 39, we see that the roof it represents has no other points of attachment to the shed than the wall-plate at each side. The arch it forms is rigid enough in itself without other support. It is safe to stretch as far as 16 feet in this primitive way, provided, of course, that the frame of the shed is stable. With good posts, such as we fully referred to above, available, and erected in the way we pointed out, a firm enough erection to hold the roof we suggest in position can easily be

assured. A 6-inch by 2-inch, or at the outside an 8-inch by 2-inch, wall-plate would be sufficient; and if thought necessary, a 9-inch sarking-board could be run along each side under the eaves. This and the gable-heads down to the same level (*i.e.*, the under side of the sarking-board) would be the only parts of the shed requiring protection of the kind. The length of the posts available would govern the height of the shed, which need never be less than about 16 feet to eaves.

A few hundred feet of this sort of shedding, 16 feet by 16 feet, would surely be a boon at the majority of arable farms. At not a few, as we remarked before, something of the kind is indeed fast becoming a necessity. The price cannot be called prohibitive. The roof alone, say, of No. 22 corrugated-iron, would be about 5s. per running foot of shed. Were rhones or eaves-

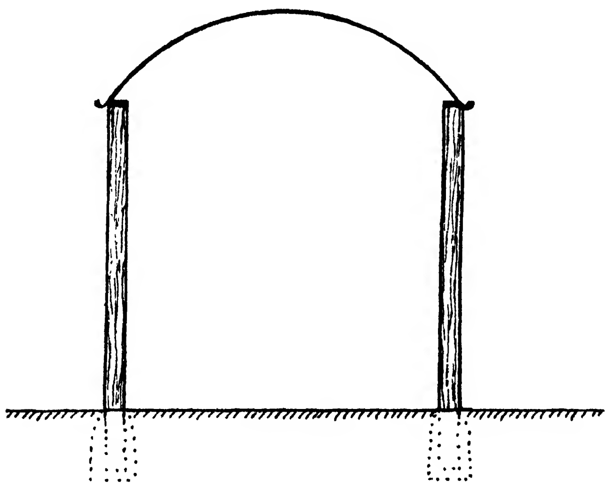

Fig. 39.—*Section of shed without roof-trusses or frames.*

gutters to be added, other 11d. a foot would be incurred. These cost from 4½d. to 5d. a-foot; but then we have them at each side, and something has to be included for the drop-pipes or conductors. The wall-plates, too, might perhaps have to be bought in. But were the estate self-supplying in such elementary prepared timber as these imply, they and the posts being at hand would not necessitate direct outlay of money over them. More than likely their indirect cost would be far above the market price of imported stuff of the same description; but that is a point of economy that can be looked at from more sides than one. With posts and wall-plates forthcoming, therefore, from the estate, there is not a great deal for the proprietor to face in the other parts of the shedding that remain to be provided.

We have seen what the roof itself runs to. The excavation of the post-holes and the filling of these thereafter with concrete is often no small affair. Much depends, of course, on circumstances. Where the subsoil is free, and at same time gravel or other stuff suitable to be used as a base in the concrete is easily obtained, the matter is not very arduous. The holes may have to be cut in rock, however, and gravel or the right kind of stone may not be at hand, both of which being conditions that lead to extra expense—the one in labour alone, the other in carriage as well.

But even with the posts and wall-plates gratis in a certain sense, a proprietor may think he does well in the erection of these, and that the tenant may then in all fairness take up the running by providing and fitting up a roof thereon. And many a tenant would rather do so than leave the proprietor to do all and charge him interest on the outlay. It would be too permanent a job for the tenant to take in hand himself, even when guaranteed compensation at the close of his occupancy. There is nothing for it, we are afraid, but for the tenant to fall back on the sort of shed we have just been describing—that of the wood post and iron roof. He can hardly be expected, however, to go to the expense of such posts as we found the proprietor was able to obtain, and to give them such a setting in the ground as the latter was supposed to do. He would have to rest content with slimmer posts, and as a consequence a shed of somewhat smaller dimensions than the one above. Could he manage to fall in with some cast-off telegraph or telephone poles already spoken about, he would have useful material at his command, and be justified in erecting as large a shed as before; but failing these, his larch or Scots-pine poles would oblige him to be satisfied with something smaller.

It might be worth the farmer's while to look out for new poles similar to those in use for carrying overhead wires, and thus secure a good article and a fair-sized shed. They are, no doubt, to be had if one knew where to apply for them. This class of pole is, as we stated above, steeped in creosote before use, and whether secondhand or new, need hardly be set up in concrete, the preparation we refer to rendering them proof for a long time against the trying position of wood set up with one end in the soil. That this position tells sorely even on them is apparent from the condition of those that have done their term of service. But there is usually enough and to spare of the cast-off pole above ground-mark that is firm and sound enough for a fresh term of usefulness. Even it, however, will repay a thin collar of cement plaster 18 inches

deep, so long as it stands an inch or two clear of the surface. Such a protection, if no more than an inch thick, provided it remain whole, will prolong the life of the post considerably. The same is almost indispensable in the case of the other class of pole we hinted at being used. Since so small a means has so great an effect it is poor economy not putting it in force.

Care must be taken to sink the ends of the posts pretty deep in the ground—3 feet at the least we should say—and to pack the soil firmly around them. Sixteen feet will be as great a width as one will be justified in setting up the shed, unless, of course, the posts are of a superior class. The height will, as we have said, be ruled by the length of the posts. White pine battens, 6 inches by 2 inches, will make efficient wall-plates. These must be firmly attached to the heads of the posts. A long wood screw, such as fig. 40 shows, is the best and easiest thing to effect this with. If the posts are good, the distance between each may be stretched to 12 feet; if but of medium strength, a 10-feet space is ample. The crown of the roof should not be less than 5 feet above the level of the top of the wall-plate. The upper outer corner of the wall-plate is better to be chamfered or bevelled off a little, so that the sheets may get a better bearing than they would get were the sharp edge allowed to remain. Rhones are of course very desirable, but they may be dispensed with. It would be well, however, in their absence to have the board above referred to along the eaves. To make the shedding more secure, it is advisable to pass over the roof from side to side, at regular distances apart, a length of strong strand fencing wire (galvanised). This lies close and out of sight in one of the hollows, and if firmly secured by bolt or screw at each end to the wall-plate serves wonderfully to stiffen as well as better bind together the structure as a whole.

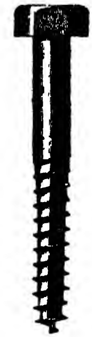

Fig. 40.—*Wood screw.*

It is easy to reckon the cost of a range of shedding on these lines. Let us take 100 feet, 16 feet wide and the same in height, for example. That means twenty-two side-posts and two end ones to start with. The wall-plate (down both sides and across ends) runs up to 232 feet. About 300 feet of 9-inch sarking-board will do to close in gable-ends and run along under eaves. Only the roof-sheets remain. Of these, 150 will be required to cover in the space on hand, three, each 7 feet long, being needed to the arc of about 20 feet described by the roof, and each sheet covering 2 feet in breadth. Putting these

several items in order, the cost will work out at something like the following:—

24 posts 19 feet long and averaging 9 inches in diameter at, say, 7s. 6d.	£9 0 0
Fixing them in the ground, say . . .	4 10 0
232 feet of wall-plate at 1½d.	1 9 0
300 feet of 9-inch sarking-boards at ¾d. . .	0 18 9
Galvanised corrugated-iron sheets and screws, &c., for fixing them	25 0 0
200 feet of rhones and 64 feet of drop-piping at 4½d.	4 19 0
Fitting up wall-plate and boarding and fixing sheets	3 0 0
	£48 16 9

Say £50, which is equal to 10s. per running foot of shedding.

The Position of the Sheds at the Homestead.

Where to place the sheds with relation to the other buildings is not a difficult matter, unless, of course, the configuration of the ground comes in as a disturbing factor. The correct position of the hay-shed is near where the bulk of the hay falls to be consumed. At the ordinary farm this happens in the stable, consequently as near as possible to the latter we can manage to erect the shed the greater will be the economy of labour in filling the mangers with hay. If it can be so contrived that the hay

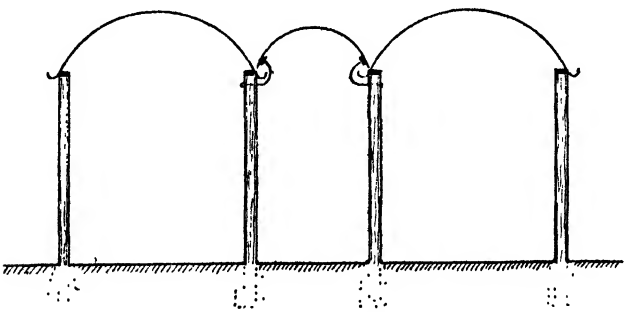

Fig. 41.—*Section of combined sheaf sheds.*

may be carried under cover directly from the shed into the stable, or into the hay-house, if there be such a place in connection with it, all the better. At the dairy-farm a great deal more hay is provided for the cows than for the horses. In this case, therefore, proximity to the byre rather than the stable ought to be observed in placing the hay-shed. In fact, at a place of this kind there ought to be two sheds, one for the byre and another for the stable. There is one kind of hay

for the cows, another for the horses. Meadow-hay is made for the former, while the horses get that made from the rotation grass. If there is to be but one shed at the dairy-farm, it should be placed as near as possible to the byre.

The sheaves having all eventually to be consigned to the threshing-floor, it stands to reason that the site of the corn-shed or sheds should be so contrived that they will be in direct touch with the corn-barn. We have already hinted how these sheds might be arranged in order to save as far as possible the labour of carrying the sheaves from the stackyard to the threshing-mill—how it may be arranged either to convey them in hand-trolleys or to deliver them in the barn on a travelling endless band, and thereby do away with horse-and-cart work. On fig. 41 we show in section how the sheds may be arranged in order to admit of either method being adopted. Two sheds are placed parallel with a roofed-over space between; the latter, being in line with the barn-door, brings the shed on each side of it into direct communication with the threshing-mill. The covering of this opening is a very simple affair. It trusts to the shed on each side for support. A slight wall-plate is erected on each side on iron supports attached to the posts of the sheds and bent in such a manner as to clear the eaves of the main erections. The bent sheets are fastened to these wall-plates, their ends barely touching the roof on either side, the rain that

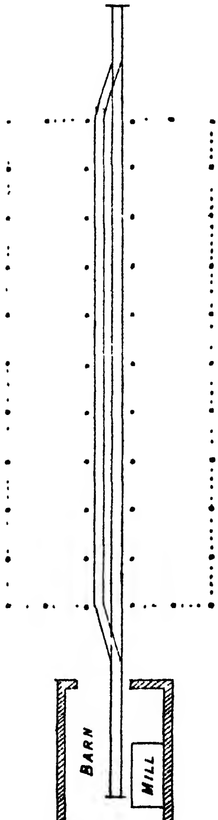

Fig. 42.—*Plan of sheaf-sheds connected by rails with barn.*

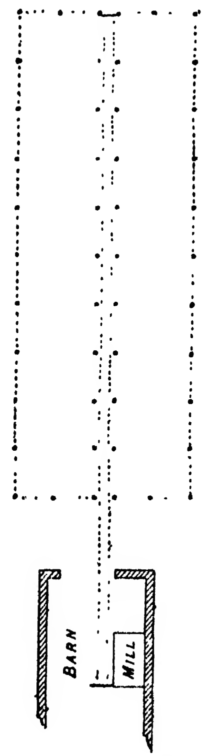

Fig. 43.—*Plan of sheaf-sheds connected by endless band with barn.*

falls upon them dropping on the main roofs and thence into the rhones along their eaves. We may dispense with rhones along the outside eaves of this double row of shedding, but we can hardly do so inside when we roof the space between the sheds.

A wider passage would be required where the trolleys were used than would serve the purpose where the travelling-band arrangement was installed. Room for two sets of rails would be needed. Nine feet clear between posts would do. We show on fig. 42 a ground-plan of how this arrangement may be carried out. Two trolleys can in accordance therewith be kept going without interfering with each other. When one has been emptied in the barn it can be run on to the unoccupied rails, leaving a free passage for the other to be delivered of its load. If not convenient to take sheaves from both sheds, the empty

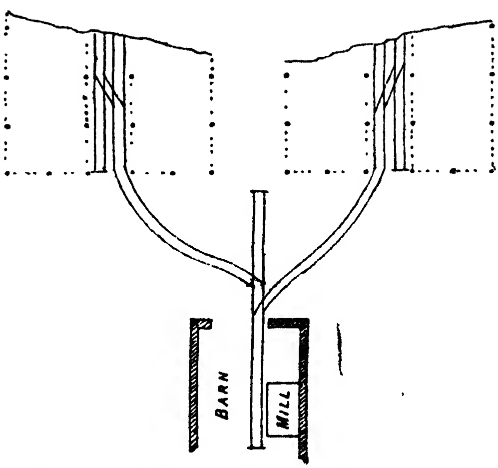

Fig. 44.—*Plan of increased shedding to be worked on the trolley system.*

trolley can be pushed on to the terminus, and thence the reverse way along the rails, serving the shed from which the sheaves are being taken. The sheds being closer together, as in fig. 43, where the travelling-band is supposed to be in force, would enable sheaves to be laid thereon from either shed as wished. A space of 4 feet would be sufficient in this case. Even less might do. The narrower the space the easier would it be on the rollers carrying the band. These would be attached to the shed posts, thus adding to the simplicity of the affair. Where practicable this method of conveying sheaves to the threshing-mill would be very conducive to economy of labour at the homestead.

How far it would be advisable to stretch rails or band from

the barn-floor, and consequently what length the rows of shedding might with advantage be run to, are questions not to be answered right off, so much depending on the power at command and so on. A hundred feet would be a safe limit at any rate. But at many farms 200 feet of shedding for sheaves would not suffice for the crop. How this might be doubled we

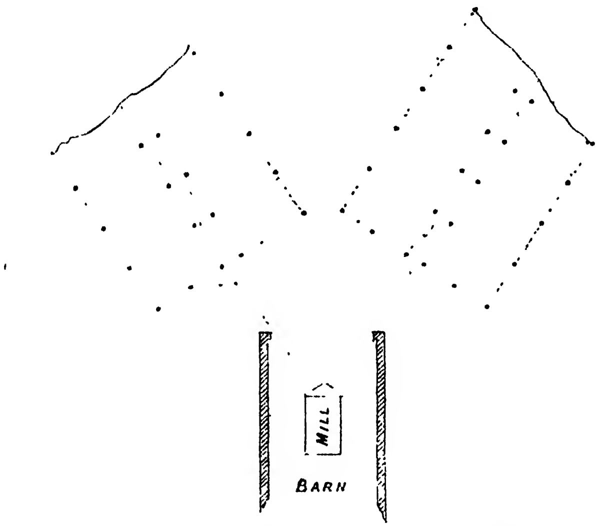

Fig. 45.—*Plan of increased shedding to be worked on the endless band system.*

exemplify on fig. 44. This arrangement of the shedding hardly works out so well for the band as for the rails; but, as fig. 45 shows, it is not at all prohibitive to that either. It may look a little unconventional to spread the rows out fan-wise, but the object in doing so, we need hardly say, is to obtain convenient access to the threshing-barn.

BOXING SEED-POTATOES.

By JOHN SPEIR, Newton Farm, Glasgow.

THE system of germinating seed-potatoes in boxes, or, as it is popularly called, boxing potatoes, was in use on a large scale for many years in Jersey and in Cheshire, and probably other districts, before it was practised in Scotland. The history of

the introduction of the system into Ayrshire is interesting, as showing how, from an insignificant hint, capable men, suitably situated, may develop an immense industry.

It is within my knowledge that between 1866 and 1870 dishes of potatoes were produced by plants grown in the open in a garden in the parish of West Kilbride, Ayrshire, about the second or third week in June, and from that to the end of the month, as the season was favourable or unfavourable. I have reason to believe, although I do not absolutely know, that these potatoes were grown in pots prior to being planted out, some shelter being given in rough weather. With the varieties then available, we would still consider that date early.

West Kilbride was at that time the earliest district in Scotland for the production of potatoes, and in order to get them early, in a favourable season, large areas were planted in the latter half of January, and in ordinary seasons in February or March. Occasionally tubers got injured by frost in the drill, but losses by frost after the plants came through the ground were very much the same then as they are now. Planted unsprouted, but earlier than now, there was not much difference in the dates when the plants came through the ground between the old and new methods. The date at which the last spring frosts occur, regulate the time when the sprouts should come through the ground, which necessarily varies with each season and district. Although plants from boxed and unboxed seed may come through the ground at the same time, those from boxed seed seem to grow quicker and mature their tubers earlier than the others.

After a time Girvan took the lead as an early-potato district, and by degrees the trade gradually drifted from the one end of Ayrshire to the other, very much to the loss of West Kilbride, which for a time almost entirely went out of early-potato growing.

For some years, about 1880, the late Mr John Wood of Chapeldonan succeeded in maturing small areas of potatoes earlier than usual, by allowing the sets or seed to lie a foot deep or so on a barn-floor, the whole meanwhile being covered with cocoanut-fibre, straw, and other similar materials. Later on he began to sprout the sets in flower-pots and odd boxes, and in this way succeeded in getting small areas of fairly early crops.

About this time Mr Thomas Hunter, sen., implement-maker, Maybole, when on a visit to the farm of the late Mr Whitlow, Preston Brook, Cheshire, had the system as carried out there explained to him. He thought it should succeed on the Ayrshire coast, and on his return explained it to Mr David Hastings, Jameston. Soon after Mr Whitlow was in Ayrshire

buying seed-potatoes, and in a woodyard near Ayr station he had a pattern box made to his direction for Mr Hastings. This was somewhere between 1881 and 1883. From this pattern Mr Hastings had sufficient boxes made to give the new method a fair trial the following year.

A characteristic story is told of the late Mr James Lyburn, potato merchant, Glasgow, who also had the farm of Balchriston, Maybole—a story all who knew him, and can remember his cheery nature and ready wit, can appreciate. Mr Lyburn had heard of the box being made for Mr Hastings, and the purpose for which it was to be used. He thought his neighbour was thus likely to steal a march on him, so he at once set out for Cheshire to see the boxes for himself and make inquiries there. He had been informed that a certain Mr Marsh practised the system of boxing his seed-potatoes. He drove up to the farm and inquired for Mr Marsh, but was informed by Mrs Marsh that he was from home and would not be back till late. Near the house was a considerable heap of empty potato-boxes which attracted Mr Lyburn's attention. He at once inquired if these boxes were for feeding pigs or hens, or what, when he was told they were potato-boxes. He then gathered all the information he could, lifted a box, and threw it into his trap, saying, "I am going to take this: tell Mr Marsh I will pay him for it if we ever meet." This box he took home and had others made from it; and the system proved so successful in his hands that he in a short time had as many boxes as held the whole of his seed-potatoes, which covered about three-fourths of his whole farm.

From these two centres the boxing system was introduced to two or three favourably situated farms, and although nothing like the good results now obtained were at first realised, yet as experience was gained in the handling of the seed, and the selection of the proper varieties, earlier and heavier crops were gradually raised.

Like all other movements which necessitate a radical change, the system of sprouting seed-potatoes in boxes spread slowly at first, and was practised only by a very few. The results, however, could not be hid, as those farmers using boxes were found to have earlier and heavier crops than those who did not. By degrees the system extended, until at the present time it is in common use not only on the Girvan shore, but all along the shores of the Firth of Clyde, on the one side from Southend in Kintyre to Dumbarton, and on the other from the Mull of Galloway to Fairlie, and also in the islands of Bute and Arran. Not only so, but instead of being confined to the shore districts of the south-west, which are tempered by the Atlantic winds,

and in easy and quick connection with the principal large centres of population all over Scotland and the north of England, it has spread to places several miles inland, and for some years it has been extensively practised in the Carse of Gowrie and elsewhere in the east of Scotland.

The Principle of Boxing Seed-Potatoes.

The system of growing potato sets in boxes for some time prior to planting in the field or garden is analogous in principle, although different in practice, to that of sowing half-hardy garden seeds under glass in spring for planting out later on when the weather becomes milder. In both cases the object is to save time. In the case of the half-hardy garden annuals, such as stocks, asters, and other similar plants, if sown in the open, the season is too short to allow them to attain sufficient size to flower satisfactorily. If, however, the seed is given the protection of a glass-frame, with or without heat, the plants are 1 or 2 inches high before the weather is sufficiently mild to permit of their being safely planted out. This start enables them to produce a full crop of flowers in our climate, and without it the blooming would be very unsatisfactory.

Custom in Northern Countries.

In Norway, Sweden, Canada, and other countries the same course is pursued with all classes of cabbage plants which we are in the habit of growing in the open during the winter, but which they must sow under glass in spring owing to their severe winter. The potato is as much a half-hardy plant as the stock or aster, and by being well started into growth in boxes or otherwise in spring, its available period of growth is considerably lengthened, and the opportunity afforded of making the maximum return permitted by the soil and season. It is not, however, necessary to grow the potato in earth when under protection, as must be done with the half-hardy annuals, and as was done by those who attempted the sprouting of potatoes first, and is occasionally done yet in Norway and elsewhere. Neither is it necessary to put the potato sets under glass. In countries with a very short summer the potato does not mature well unless the seed is sprouted prior to planting, and in some instances I understand the custom is to start the potatoes in earth in boxes before planting in the field. In Scotland such is not at all necessary, and I question even if it is so anywhere, as keeping the sets quite dr has been found to be much handier, and to give equally good f, not better, results in practice.

Boxing of Early Varieties.

If the variety of potato grown is an early one, which it is desired will mature its tubers at the earliest possible date, the seed, if carefully sprouted before planting, will not only produce an earlier but often a heavier crop than if planted in the usual way.

Puritan is the early variety most in demand in the Girvan district at the present time, it being considered a week or ten days earlier than anything else. Nonsuch, Early Regent, British Queen, Conquest, &c., being in less demand, are grown on more limited areas.

Boxing Late Varieties.

If the variety is one which easily produces its maximum weight in any ordinary season, and date of ripening is of no material consequence, little advantage need be expected from sprouting, other than that which results from a more uniform crop compared with one more or less blanky. Our seasons are not all favourable, as with similar varieties, land, and manuring, the produce of one season often doubles that of another a year or two before or after. It also often happens through sprouting in the pits, blind eyes, and heating of seed, that the plants are anything but uniformly distributed over the ground, the yield in consequence being more or less reduced. Sprouting the seed admits of a good crop being produced even when the season is anything but favourable, and as with due care every set becomes a plant, blanks are few and far between, so that variations from this cause are reduced to a minimum. It is thus easy to understand that while sprouted seed in certain years might give little if any better results than that which was unsprouted, yet on the average of a number of years the sprouted seed may have a considerable weight to its credit.

Boxing Seed-Potatoes to retard their Growth.

It occasionally happens that it is desired to plant a crop of potatoes after some crop has been cleared off the ground in late spring or early summer, such as cabbage plants, early turnips, winter rye, or parsley, &c., or to plant potatoes on headlands late in the season. Under such circumstances the boxing of seed-potatoes comes in very useful for retarding the growth of the bud till such time as the crop can conveniently be planted. With any second early variety, the tubers of which are put in the boxes about the time the eyes begin to swell, and are afterwards well exposed to light and kept as cool as the circumstances permit of, there is no difficulty in keeping back the

growth of the buds to within 4 to 5 inches till the middle of June or even the end of that month. Sets of any of the early or second early varieties so planted, in a fairly moist season will produce a moderately full crop of very evenly sized potatoes in a remarkably short time.

In this way headlands may be planted after the ordinary crop is well up, the crop on the headlands being saved from the damage which usually results from the feet of the horses and the tines of the grubbers or cultivators. If the headlands are planted after the drills of the ordinary crop are harrowed down with the saddle-harrows, and before cultivation of the drills begin, a considerable amount of work can be done before the potatoes on the headlands come through the ground. They are thus in great part free from damage from the feet of the horses; and as they afterwards make very rapid progress, a fair crop can often be depended on. The only drawback to this method of cultivating the headlands of a potato-field is that unless the principal crop is a very late ripening one, the crop on the headlands may not be ready to lift when it is desired to raise the crop in the field. In that case it is necessary to hand-dig sufficient off each end of the drills to allow the potato-digger to turn in and out.

Other Advantages of Boxing Seed-Potatoes.

In the growth of an ordinary crop of potatoes there is also another gain which is well worth considering. To get the full advantage out of any potato-seed the buds should never be allowed to get so long as to be broken off before planting. In any ordinary season it is a necessity of the successful cultivation of the potato that the first bud should be retained on every set, it being so much stronger than any of the succeeding ones. Unfortunately this is not always done. Every care should therefore be exercised in order that germination is not prematurely started, or when started, that the bud is not broken off in the course of handling. In a mild winter, more especially if the tubers have been pitted damp or with many diseased ones among them, or if the pits are large, growth becomes too far advanced, and the tubers cannot be dressed without breaking the buds.

No other system of treating seed-potatoes yet introduced enables the first bud to be kept on so readily as that of putting the potatoes intended for seed in shallow boxes or trays before any of the buds have begun to swell, and keeping them there till they are planted. With sets so treated the buds, according to the temperature in which they have been kept, may not exceed $\frac{1}{8}$ inch or $\frac{1}{4}$ inch long, or they may be

anything up to 4 or 5 inches long. If the growths are only from ⅛ to ¼ inch long, the seed of most varieties may be emptied into the apron of the planter with little fear of damage in the course of planting. Seed with buds over ¼ inch long should, however, be transferred direct from the boxes to the drill by the hand.

Comparison between the Buds of boxed and unboxed Potato Sets.

The buds on a potato as ordinarily seen when taken from a potato-pit or -heap are usually white, brittle, slender in the stem, long-jointed, and with a very weak attachment to the tuber. Under such circumstances the growth is very easily broken off at the root or across the middle, either of which mishap would materially reduce the produce of that plant. In

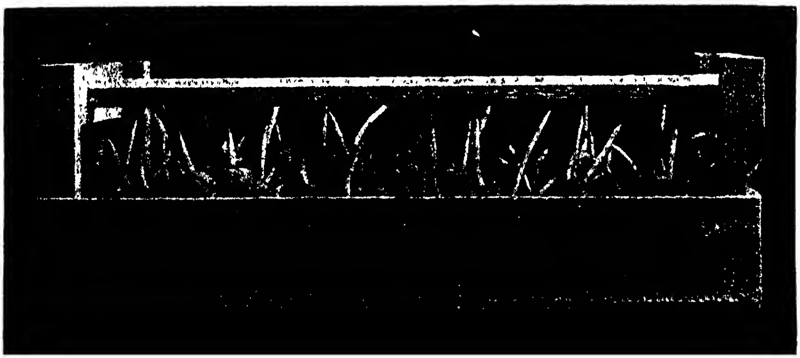

Fig. 46.—*Box of potatoes ready for planting.*

boxed seed, not too hard forced, and exposed to moderate light, the growths are bluish-green in colour, thick in the stem, short jointed, very elastic or tough, and have a firm attachment to the tuber. Although bluish-green is the prevailing colour for most varieties of potatoes which have had their sprouts fully exposed to light and air, it is not the only one, as each variety has a tint peculiar to itself. These tints extend from red or pink through blue and green. With ordinarily careful handling the growths run little risk of breakage, but the manner of handling the seed must be very different from that of unsprouted potatoes (fig. 46).

Boxes.

The boxes or trays used are of various sizes and shapes, each district as a rule using some pattern and size peculiar to itself.

In Jersey a box about 2 feet long by 1 foot wide, with cross-bars at each end 3 or 4 inches above the box, and a centre bar from the one end bar to the other, is in common use (fig. 47). As

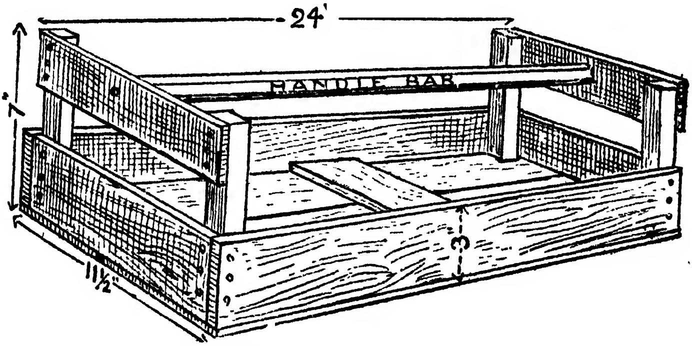

Fig. 47.—*Pattern of potato-box common in Jersey.*

this box is light enough to be carried in one hand, the central bar admits of it being easily carried in that way (fig. 48). In the fruit districts of Kent baskets are largely used for sprouting potatoes, and if not filled too deep they serve the purpose very well, at no direct outlay for them, as they are required for fruit

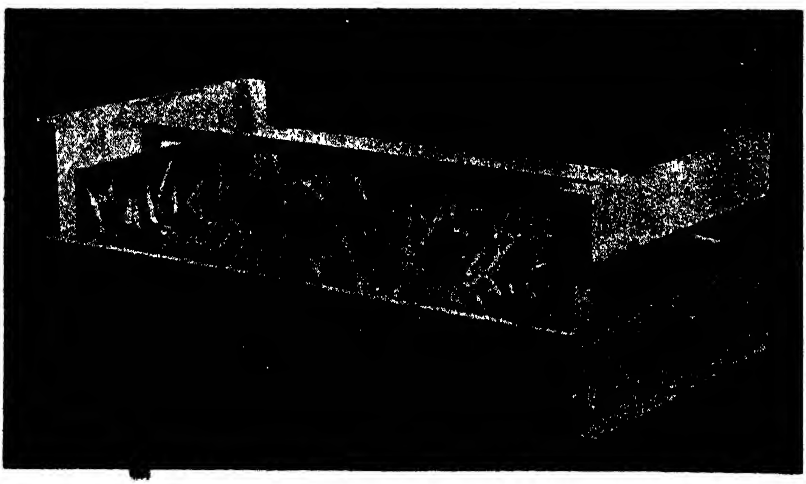

Fig. 48.—*Jersey box with central handle for carrying.*

at any rate. In Ayrshire, and all along the shores of the Firth of Clyde, the size in general use is 2½ feet long and 1½ foot broad and 4 inches deep, with handles at each end (fig. 49).

All the boxes have upright pieces of wood in each corner, the tops of which are about 4 inches above the sides of the box. The end handles are nailed to these, but their principal use is to permit of each box sitting on the top of its neighbour, and

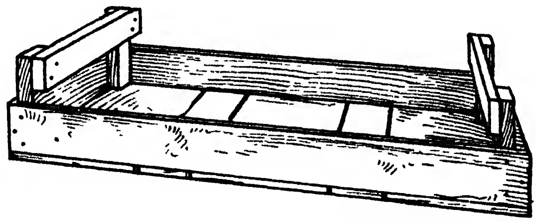

Fig. 49.—*Pattern of potato-box common in Ayrshire.*

yet giving headroom enough for growth, ventilation, and light. Boxes without handles can be readily used for storing and sprouting, but are not so easily carted to the field, particularly if the sprouts are long.

Cost of Boxes per Acre.

According to the quality of the wood used, the Ayrshire pattern of box costs from 7d. to 9d., and the smaller Jersey box from 3½d. to 6d. From thirty to forty boxes of the larger size are usually required to hold sufficient seed for one acre, so that the capital expenditure for boxes may be said to run from 25s. to 30s. per acre. Where properly taken care of, the boxes will last for a long number of years, but the yearly upkeep is a considerable item, as in the handling and cartage to and from the field handles get broken, corner posts knocked out, and other injuries occur.

When the Potatoes should be put in the Boxes.

If the variety is an early one which it is desired to dig as soon as the tubers are a moderate size, the potatoes may be put in the boxes any time after the middle of July. When the crop is being dug in July or later, the seed size of potatoes are separated from the others, and at once put into boxes, where, being well ventilated and dry, they keep better than anywhere else. Late varieties may be put in the boxes any time after digging till the end of January. As the boxes are usually only from 3 to 4 inches deep, the potatoes are seldom over two deep in them, and are emptied in without any care as to whether or not the bud end is up.

Size of Seed.

For sprouting in boxes only whole potatoes are suitable, as cut ones either dry up or rot, or a large proportion of them have dormant or dead eyes. Potatoes over 1¼ inch in diameter and under 2 inches are generally used, the popular size being between 1½ inch and 1¾ inch in diameter. Larger sizes may in many cases be used with advantage, but unless the seed is very cheap the extra weight necessary to seed an acre is a serious obstacle to their use. With tubers under 1¾ inch in diameter it is only occasionally that more than one growth comes from each potato, but with full-sized or extra large potatoes two or more eyes may start into growth. If it is desired to start every bud so as to cut large tubers into small sets, the first buds should be broken off, when all or the most of the others will start into growth. With such seed the tubers may be cut to single growths just before planting without any risk of harm being done.

Storing Seed during Winter.

For those who have not previously tried this method of preparing potato-seed, and who are only likely to have a comparatively small quantity, no better place exists for storing the seed during winter than on the joists above feeding bullocks, cows, or other cattle. The heat of the air respired by the cattle is usually sufficient to keep off any moderate frost, but if the place should be draughty or the cold excessive, extra protection should be given by covering the boxes with dry bags, straw, or hay. In storing potatoes above stock, care should be taken not to have them too close to ventilators or even windows, as during frost, or more especially frost with wind, considerable damage may be done before it is even suspected (fig. 50).

Where stored otherwise than above stock, provision should always be made for providing artificial heat of some kind, else the tubers may at times be entirely lost. On cheese-making farms the cheese-rooms are usually heated by a saddle or other boiler and hot-water pipes. These buildings are often empty during the coldest part of the winter, and where available they should be taken advantage of. The potatoes may be stored in any outbuilding till frost is imminent or the cheese-room or other building is empty, when they may be removed to it.

Heating by hot water is the best possible method of providing artificial heat, as it has little tendency, like fires, stoves, or braziers, to overheat one part of the building and leave another too cold. I am not, however, aware of any instance where hot-water pipes have been put in solely for heating potatoes. Whilst

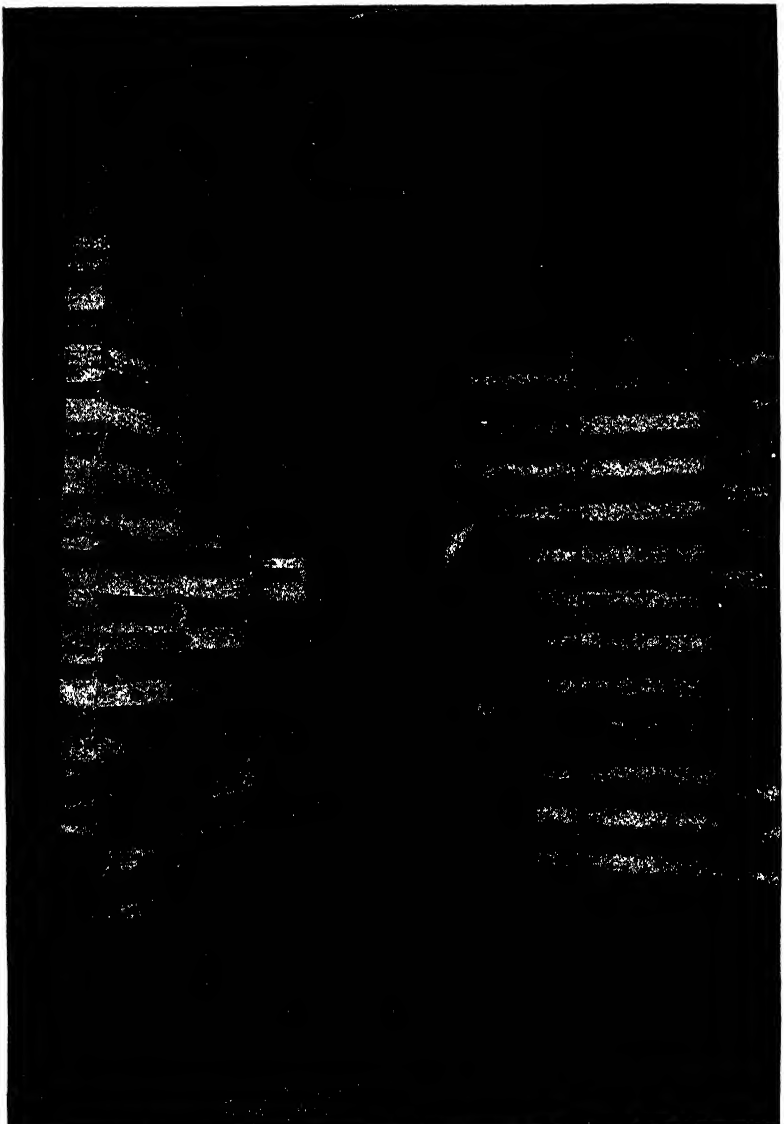

Fig. 50.—*Method of storing potato-boxes.*

the provision of some form of heating is an absolute necessity as a guard against frost, it is also very useful for pushing on seed which has been late in being boxed, or has been kept too cold, and consequently has not become sufficiently sprouted.

Treatment of Seed too much or too little sprouted.

According to district, season, variety used, and the purpose for which the crop is grown, the seed may not be sufficiently sprouted, or may be too far advanced, before the date for planting arrives. All roots and tubers seem to be more easily forced into growth before their natural time if allowed a certain period of rest, which varies with the variety. For instance, rhubarb-roots, which are largely forced into growth during January, February, March, and April, invariably force easier and yield better the longer the period of rest, or the nearer is the natural period of growth before the forcing is begun. The leaves of rhubarb usually die off in the latter end of October, varying a little with the season, variety, and locality. If the roots are dug soon after and put into a forcing-house, no amount of heat or moisture will cause them to start into growth. The roots instead will die, and the earlier the roots are raised, and the greater the heat and moisture, the greater will be the death-rate and the less the produce. The same applies to daffodils and narcissi, which are largely forced into flower during the winter and spring months, and to a greater or less extent to all plants or flowers used for forcing purposes. When the period of rest peculiar to the potato plant has elapsed, if the conditions are favourable, growth at once begins. Potatoes raised when immature or green, if kept all the time in boxes, will germinate and mature a crop as early as if they had been allowed to ripen naturally. If growth is backward and the date of planting is approaching, a slight increase of temperature may make a great difference in a few days. Where the air is moist, such as above stock, growth is more rapid than, say, where the same temperature is maintained by a stove, where the air is usually very dry.

Darkness also favours growth, but at the expense of long-jointed and brittle stems, neither of which is desirable or profitable. It occasionally happens that growth is too far advanced, or the stems are white from excess of heat or absence of light, in which case exposure to light and a cooler atmosphere may not only prevent further growth, but very considerably toughen the stem and the attachment of the stem to the tuber. If the weather is sufficiently mild to warrant the proceeding, boxes which are becoming too advanced in growth are occasionally spread out in the field one or more deep. Exposure to

light and air in open sheds or barns, if these are available, will attain the same end with less risk, and in either case growth will be materially checked, and the stems toughened.

Date of Planting.

Properly sprouted seed-potatoes, according to date of planting, variety, and district, invariably send the stem through the ground from one to three weeks earlier than similar tubers unsprouted but planted at the same time. If, therefore, there is any danger of frost, the planting of the sprouted seed should be delayed, so that by the time the sprout appears above ground all this danger is past.

There need not, therefore, be any particular hurry in planting sprouted seed, unless both season and soil are favourable for this operation, as there is less risk of a diminution of the crop from late planting than there often is with unsprouted seed. Where the crop is usually dug in June and July, some risk of frost is always run in even the most favoured districts, as, for instance, when in 1894 most of the districts growing early potatoes were subjected to from 5° Fahr. to 10° Fahr. of frost on 20th, 21st, and 22nd May. Such a low temperature if continued for any length of time necessarily destroys all potato growth above ground. Frost so late is, however, a risk which cannot be guarded against in the growth of this crop in the earlier districts, but in very late districts it may be reduced to a minimum by judicious sprouting and late planting.

Method of Planting.

If the growths are greenish blue in colour and do not exceed ¼ inch in length, the seed may be planted in the usual way by hand, by emptying the boxes into the apron of the planter. Such seed will suffer little or no damage in the handling; but if the growths are white, or over ¼ inch long, the boxes should be carted to the field, and the tubers transferred direct from them to the drill. In doing so each pair of planters usually carry one of the larger size of boxes between them, each planter doing one drill (fig. 51). The drills planted by each pair may be contiguous where the variety is a late one and the drills 28 inches or so wide; but in the early districts, where the drills are only 24 inches to 25 inches wide, there is often a drill missed between each pair of planters. This missed drill may be planted by a second pair following behind or by the first pair when returning. With the smaller boxes each planter carries one box in the left hand and plants from it with the right, in the usual way.

At one time it was the custom to remove all the seed from the

sprouting-boxes to light flat shovels or trowels, something like a house crumb-shovel (fig. 52). These were filled by the person in charge of the planters, or other careful person, and handed to the planters, who carried them in their left hand and did the planting with the right. Few persons now follow this method,

Fig. 51.—*Method of planting potatoes from boxes.*

planting direct from the boxes being the general rule. Owing to the slight difficulty of handling sprouted compared with unsprouted sets, planting is somewhat more tedious but much less than most people would suppose.

A method of distributing the boxes has been practised in the

Monkton district which seems worthy of adoption wherever boxes are used. It was first suggested by Mr W. S. Hamilton, Springside, to Mr Thomas Howie, Fairfield Mains, Monkton, who at once put it into practice. Mr Howie had a platform made 13 feet by 3 feet 6 inches, which he fitted on the frame of his broadcast sower. On this he places two rows, of five boxes each, which is sufficient for drills of moderate length. If occasion requires, the boxes may be set on the top of each other, and thus a greater number may be taken. In this way sufficient boxes may be carried to plant the very longest of drills, or to go and return where the fields are smaller. In work the carriage moves in front of the planters, who fill their scoops or shovels from the boxes as required, all empty boxes being carried to one or both ends, instead of being left along the drills as at present. Several of Mr Howie's neighbours have adopted this method of distributing the boxes, and his idea is that it is capable of much further extension, as he considers that by it three planters can do as much as four by the old method.

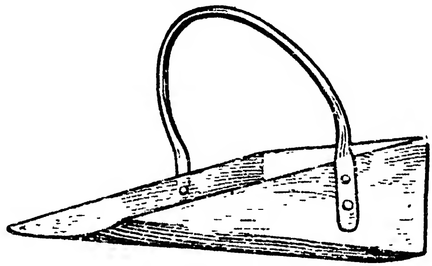

Fig. 52.—*Shovel to which the seed-potatoes are transferred from the boxes, and from which they are distributed in the drills.*

Covering the Sets, &c.

No special precautions require to be taken in covering the sets other than that the horses' feet should come as little in contact with them as possible. The growth should be entirely covered, the after-treatment in no respect differing from that of a crop planted in the usual way, though it has to be borne in mind that the sprouted sets come very quickly through the ground in a genial spring.

Experiments in 1901.

With the object of bringing this system of preparing seed-potatoes into wider notice, and of testing its adaptability to different districts and to late varieties, the Directors of the Highland and Agricultural Society arranged for the carrying out of a number of trials in the season of 1901. In these experiments, which embraced eight experimenters and ten separate experiments, two were not weighed: one, because crows

had so damaged the plots that any comparison would have been useless; and the other, because no difference could be seen between the plots. In all the cases the plots were one-eighth of an acre in extent, but the weights given in the tables are calculated for one acre. The potatoes were put in the boxes between 13th December and the end of February. Those who were late in boxing the seed seem to have given no artificial heat to bring it forward, and at the date of planting it was little more advanced than was the unboxed seed; in fact, in one case the boxed seed was said to be less sprouted than that taken from the pits. It is only where the seed was put in the boxes moderately early that any gain is reported. Nearly all the experimenters say that the seed was not sufficiently sprouted when planted, and this is likely to have been the case. In my own case, where the potatoes were put in the boxes on 10th January, the sprouts were only $\frac{1}{8}$ inch to $\frac{1}{4}$ inch long when planted, the variety being British Queen. No heat was given unless what was necessary to keep out frost, the heat being obtained from a coke-brazier. This lot of potatoes might with advantage have been from 1 inch to 3 inches long.

Several of the experimenters report that the potatoes which had been boxed were through the ground about a week earlier than those not boxed, while others report that there was little or no difference. If sufficiently sprouted and the weather is favourable for growth, it stands to reason that those well sprouted will be through the ground first. In my own case, with a second early variety, British Queen, planted on 28th March, at which date there was little growth, the boxed potatoes were only a day or two earlier than those not boxed. From the time they were a fortnight through the ground until they were thoroughly closed in the drill, the boxed seed had the strongest plants and most uniform crop, but after that no difference was discernible till the leaves dropped off, when it was noticed that the boxed plants had much the strongest and most upstanding stems. Somewhat similar statements are made by several other experimenters. As showing how quick properly sprouted potatoes not only come through the ground, but grow afterwards, when the weather is mild, I may refer those interested to an instance mentioned by me in 1888, on p. 71 of the 'Transactions' of 1890, where the leaves of a crop were touching in 26-inch drills in five weeks from the date of planting.

Most of the experimenters using Up-to-Date or Maincrop varieties found that the boxed seed bloomed earlier and ripened earlier than the seed not boxed. Here with British Queen there was little difference, but with Champion II. (probably the latest variety in cultivation), the boxed seed was easily a fort-

night earlier ripe than where the seed was not boxed. The eyes or buds of this variety do not show any signs of life till late in spring, therefore the experimental plots of this variety were not planted till 24th April. For four years this variety has always been quite green with me till the last week in October, and I anticipated that if boxing gave any gain with any late variety, it would be likely to do so with this one. Contrary to expectation, there was no gain in weight of crop, although all summer the crop from the boxed seed seemed considerably superior to that unboxed. With me this variety has never been a heavy cropper, and last year it was more than usually disappointing, as the season, although generally favourable to the potato crop, did not seem to suit it.

Varieties used.

The varieties used here were not grown by any of the other experimenters, Maincrop being grown by four and Up-to-Date by two.

Proportion of Small Potatoes.

As a rule, there is not much difference in the percentage of small potatoes between the plots. This difference, although in the direction one might expect, is not constant in all the plots, and is so small that it is easily within the range of experimental error, and is therefore of no account.

Total produce of different Varieties.

Where the same variety was grown on several farms, the total produce seems to have been more influenced by the farm than the variety, or whether it was boxed or not, as the experiment does not throw any definite light on any late variety as being more suitable for boxing than any other. The following tables show the total produce per acre, grouped according to varieties:—

MAINCROP.

Experimenter.	Boxed. tons.	cwt.	qr.	Unboxed. tons.	cwt.	qr.
Mr Blair, Hoprig Mains, East Lothian	9	8	0	9	4	0
Mr Buttar, Corston, Forfar . .	8	5	0	9	3	0
Mr Glendinning, Hatton Mains, West Lothian	11	19	0	10	8	0
Mr Smith, Longniddry, East Lothian	13	7	0	12	8	0
Total . . .	42	19	0	41	3	0
Average . . .	10	14	3	10	5	3
Gain per acre . .	0	9	0	0	0	0

UP-TO-DATE.

Experimenter.	Boxed. tons.	cwt.	qr.	Unboxed. tons.	cwt.	qr.
Mr Laird, Lawthorn, Irvine, Ayrshire	10	0	3	10	0	3
Mr Smith, Longniddry, East Lothian	14	10	2	13	9	1
Total . . .	24	11	1	23	10	0
Average . . .	12	5	2	11	15	0
Gain per acre . .	0	10	2	0	0	0

It will be noticed that with Maincrop the variations range from a loss of 18 cwt. per acre by boxing at Corston, to a gain of 31 cwt. at Hatton Mains, the average gain being 9 cwt. per acre.

With Up-to-Date the experimenters are limited to two, with one of whom both plots gave the same yield, while with the other the crop from boxed seed showed a gain of 21¼ cwt. per acre. On this farm, with British Queen, the gain by boxing the seed was 30¼ cwt. per acre, while with Champion II. there was no gain.

The table on p. 165 gives the full details of each experiment, the produce being calculated per acre in each case.

The following statement, taken from the December number of the 'Journal' of the Department of Agriculture and Technical Education for Ireland, shows the results of some sprouting experiments with late potatoes, conducted last season by Mr J. L. Duncan, B.Sc. (late of Bute), county instructor for Tyrone, in certain districts of that county. Through Prof. Campbell of Dublin I am informed that Mr Duncan considers these figures reliable, all the work being done under his own supervision. Those who have the pleasure of Mr Duncan's acquaintance know him to be an exceptionally careful experimenter:—

Experimenter.	Variety of potato.	Treatment of unsprouted seed.	Yield per imperial acre. Sprouted seed. tons.	cwt.	Unsprouted seed. tons.	cwt.	Increase per acre in favour of sprouted seed. tons.	cwt.
Mr J. M'Ivon, Strabane	Scottish Triumph	Cut	16	1	13	1	3	0
Mr R. Crawford Priory, Cookstown	Black Skerries	Cut	16	12	13	6	3	6
	Old Champion	Cut	18	14	16	5	2	9
	Up-to-Date	Whole	22	16	20	10	2	6

Variety.	Experimenter.	Boxed Seed.									Unboxed Seed.								
		Small. Per acre.			Dressed. Per acre.			Total. Per acre.			Total. Per acre.			Dressed. Per acre.			Small. Per acre.		
		tons.	cwt.	qr.	tons.	cwt.	qr.	tons.	cwt.	qr.	tons.	cwt.	qr.	tons.	cwt.	qr.	tons.	cwt.	qr.
Maincrop . .	Blair . . .	2	8	0	7	0	0	9	8	0	9	4	0	6	14	0	2	10	0
	Buttar . .	1	13	0	6	12	0	8	5	0	9	3	0	7	5	0	1	18	0
	Glendinning	2	0	0	9	19	0	11	19	0	10	8	0	8	16	0	1	12	0
	Smith . .	2	7	0	11	0	0	13	7	0	12	8	0	10	5	2	2	2	2
Up-to-Date .	Laird . .	0	18	3	9	2	0	10	0	3	10	0	3	9	2	0	0	18	3
	Smith . .	1	1	2	13	9	0	14	10	2	13	9	1	12	6	3	1	2	2
British Queen	Speir . . .	1	15	0	14	13	1	16	8	1	14	18	0	13	3	0	1	15	0
Champion II.	Speir . . .	1	0	0	7	18	0	8	18	0	8	19	1	7	18	0	1	1	1
	Average . .	1	13	0	9	19	0	11	12	0	11	1	1	9	8	3	1	12	2
	Gain . . .		...			...		10	3	0		...			...			...	

Summary.

The experience of the past season may be shortly summarised as follows:—

1. The results of 1901 seem to indicate that even late potatoes may give such an increased return as will warrant the expense and trouble of boxing.
2. The total average gain from all the experiments is 10¾ cwt. of undressed potatoes per acre.
3. With a little more experience it is probable that this average might be considerably increased.
4. The season being a favourable one generally for potatoes, the probability is that the unsprouted seed produced nearer its maximum than is usually the case, and it is more than likely that in a less favourable season boxed seed might show to better advantage.
5. One season's experience does not seem to indicate that any late varieties are likely to give better results than others from being boxed.
6. This season's experience warrants a continuation of the experiments for one or more years.

[Figs. 46, 47, 48, 50, and 51 are, with permission kindly given, reproduced from the 'Journal' of the Irish Department of Agriculture.—Ed.]

TUBERCULIN AS A DIAGNOSTIC OF TUBERCULOSIS IN CATTLE.[1]

By Rev. James Smith, LL.D., Newhills, Aberdeen.

In 1899 there was issued by the Agricultural Department of the University of Aberdeen "Report on an Investigation with regard to the value of Tuberculin as a test of the presence of Tuberculosis in Cattle." On reference to that report it will be seen that, of the 100 bullocks tested, 24 were found on post-mortem examination to be tuberculous, but 4 of these had failed to react to the test. Of the 60 heifers tested, 10 were found to be tuberculous, 4 of which had failed to react; but (as explained

[1] Another investigation undertaken by the Agricultural Department of the Aberdeen University, in association with the Highland and Agricultural Society, is one which has for its object the elucidation of the question of the transmissibility of tuberculosis from man to animal and *vice versa*. This inquiry is not yet completed, but it may be stated that several calves fed with food containing the sputum of consumptive human subjects have been found to have become freely affected with tuberculosis.—Ed.

in the report) there were certain incidental circumstances which may be supposed to have contributed to the failure in the case of the heifers. Cows were tested to the number of 77, of which 42 proved tuberculous, and of these, 17 had failed to react. The temperature of the animals under test had been taken four times after inoculation—namely, at 10, at 11, at 12, and at 13 hours after inoculation.

Naturally, attention was directed to the considerable number of failures to react that were reported, especially among the tuberculous cows. And Professor Nocard, in a communication to the 'Mark Lane Express,' dated 20th November 1899, expressed the opinion that, if the temperature had been taken at 12, 15, 18, and 21 hours after inoculation, the failures to react would have been comparatively few. He added: "If it should happen that at the 21st hour the temperature of certain animals is still rising, without having reached the necessary degree to affirm that they are tuberculous, it is recommended to take the temperature a fifth time—namely, at the 24th hour after injection."

In these circumstances it appeared to the joint committee which is charged with the management of the Agricultural Department of the university that the question thus raised deserved the most careful consideration. The Directors of the Highland and Agricultural Society, which had aided the committee in carrying out the investigation above referred to, were found on application to take the same view of the matter, and intimated willingness to contribute to the expense of such a supplementary investigation as might be proper in the circumstances. Accordingly Mr J. M'Lauchlan Young, F.R.C.V.S., veterinary lecturer in the department, was authorised to proceed with a supplementary investigation in the manner he might deem best, restricting the inquiry to cows. The work was necessarily hindered by Mr Young's absence for a considerable time in South Africa on military duty. On his return the investigation was entered upon, and has lately been completed.

Mr Young's report of the results is as follows:—

"I beg leave to report that, with the permission of the Joint Committee on Education in Agriculture, I have concluded a supplementary investigation into the value of tuberculin as a diagnostic.

"In all 42 cows have been tested and carefully examined post-mortem, and I desire to express my thanks to all those who have assisted me by doing everything in their power to facilitate my operations.

"The inoculation was performed in the same manner and with the same precautions as in the previous investigation, but

it is to be noted that in cow No. 15 and onwards a stronger tuberculin was used—namely, that prepared at the Jenner Institute (late British Institute of Preventive Medicine), London, a fact which accounts for the difference in the dose. In a few cases I gave beyond the recognised dose, and am inclined to the opinion that in a few cases—notably Nos. 9, 12, and 29—a reaction was obtained which might otherwise not have been produced.

"Of the 42 cows tested 21 were found on slaughter to be tuberculous, and of these 17 had reacted to the test. Thus four of the tuberculous cows failed to react—namely, Nos. 17, 25, 32, and 37. The only lesion found in No. 17 was one of old standing, which had become caseated and encysted, so that there was no active disease. This case resembles No. 3, bullocks, in the Report of Investigation 1899. It may be questioned whether an animal thus affected should be classed as any longer tuberculous. Nos. 25, 32, and 37 were characterised by a gradual rise and fall of temperature which was suspicious. Possibly in this instance a larger dose of tuberculin would have produced reaction.

"It may be noted that the proportion of the cows dealt with that were found to be tuberculous is 50 per cent, as compared with 54·5 per cent in the former investigation (1899). The proportion of tuberculous udders is the same in both investigations—namely, almost 10 per cent.

"In explanation of the tables which accompany this report, I may say that the age assigned to each animal is the best estimate I could form in the circumstances; that 'previous temperature' means the temperature immediately before inoculation; and that in the column 'pharyngeal glands' are included affections of the tonsils. I may state further that the term 'characteristic reaction' is used here, as in the Report of Investigation 1899, in the generally accepted sense, as meaning a gradual rise of temperature to the extent of at least two degrees above the normal temperature of the animal.

"From this investigation and previous experience, I am of opinion that, in using tuberculin as a diagnostic of the presence of tuberculosis in cattle, it is advisable to take the temperature four times after inoculation—namely, at 9, 12, 15, and 18 hours after injection. In the event of the temperature gradually rising till the 18th hour, but not being sufficiently high to be deemed a reaction, I consider it advisable to take the temperature a fifth time—namely, at the 21st hour after inoculation.

"Upon the whole, I arrive at the conclusion that, under ordinary circumstances, a characteristic reaction takes place between the 9th and 18th hours after inoculation with tuberculin."

TABLE I.—RESULTS.

No.	Description.	Age.	Previous temperature.	Dose.	Temperature—hours after inoculation.				Post-mortem condition.
					12.	15.	18.	24.	
				m.					
1	Red cross, small	9	101·8	50	**103·9**	**104·0**	**103·5**	**102·1**	**Tuberculous.**
2	White polled . .	8	102·0	"	102·6	102·0	102·2	102·1	Sound.
3	White cross . .	6	101·8	55	**104·6**	**104·0**	**102·8**	**102·0**	**Tuberculous.**
4	Red " . .	8	101·8	60	101·4	101·8	101·8	101·6	Sound.
5	" " . .	12	101·0	55	101·8	101·9	101·0	101·4	Sound.
6	" polled . .	10	101·5	60	102·0	101·6	101·6	101·7	Sound.
7	Cross	9	101·9	65	102·1	102·0	101·8	102·0	Sound.
8	White cross . .	12	101·0	70	101·7	101·4	101·5	101·6	Sound.
9	Red horned, small	12	101·8	60	**102 0**	**104·5**	**104·4**	**102·1**	**Tuberculous.**
10	Cross	7	101·3	65	101·7	102·0	102·0	101·8	Sound.
11	Brindled cross .	7	101·5	70	101·0	101·2	101·1	101·3	Sound.
12	Red cross . . .	10	101·4	"	**104·8**	**104·5**	**104·9**	**102·9**	**Tuberculous.**
13	Black heifer .	2	101·2	45	**103·1**	**103·1**	**102 7**	**102·0**	**Tuberculous.**
14	Roan cross . .	8	101 2	60	**102·6**	**103·0**	**104·4**	**103·8**	**Tuberculous.**
15	Red Irish . . .	15	101·8	16	101·4	101 1	101 0	101·2	Sound.
16	" cross . . .	12	100 4	20	**103·6**	**103·9**	**104·3**	**103·0**	**Tuberculous.**
17	Black polled . .	10	101·0	17	101 6	101·7	101·5	101·4	**Tuberculous.**
18	Roan cross . .	10	101·4	20	101·0	101·1	101·2	101·0	Sound.
19	White shorthorn	11	102·0	18	101·8	101·8	101·7	101 6	Sound.
20	Black Orkney .	8	101·0	16	101·0	101·1	101·0	101·0	Sound.
21	Red Irish . . .	6	100·7	17	**102·8**	**103·4**	**104·9**	**104·5**	**Tuberculous.**
22	Shorthorn . . .	16	101·5	20	**102·6**	**103·5**	**102·9**	**102·5**	**Tuberculous.**
23	Black polled . .	10	100·9	18	**103·8**	**104·0**	**105·7**	**102·1**	**Tuberculous.**
24	Irish	10	101·3	"	**104 2**	**104·1**	**103·5**	**102·8**	**Tuberculous.**
25	Blue polled . .	9	101·0	"	101·7	102·0	101·8	101·5	**Tuberculous.**

No. 1. Lungs and bronchial and mediastinal glands affected.
No. 3. Lungs and bronchial and mediastinal glands affected.
No. 9. Lungs and bronchial and mesenteric glands affected.
No. 12. Lungs, bronchial and mediastinal and mesenteric glands, pleura, and udder affected.
No. 13. Lungs affected, and growth on lower jaw.
No. 14. Lungs, pleura, and bronchial glands affected.
No. 16. Lungs, pleura, bronchial glands, diaphragm, and peritoneum affected.
No. 17. Bronchial gland caseated and encysted.
No. 21. Bronchial and mesenteric glands affected.
No. 22. Lungs, bronchial and mesenteric glands, and liver affected.
No. 23. Lungs, pleura, and bronchial glands affected
No. 24. Bronchial and mesenteric glands, and liver affected.
No. 25. Lungs, pleura, pharyngeal and mesenteric glands, and udder affected.

TABLE I.—Results—*continued.*

No.	Description.	Age.	Previous temperature.	Dose.	Temperature—hours after inoculation. 12.	15.	18.	24.	Post-mortem condition.
				m.					
26	Roan cross . .	8	100·5	18	101·0	101·2	101·0	101·1	Sound.
27	Black & white cross	6	101·2	20	101·6	101·5	101·5	101·2	Sound.
28	Red cross . . .	10	101·0	18	102·1	101·3	101·8	101·5	Sound.
29	Black Orkney .	15	102·1	20	**102·4**	**102·9**	**104·0**	**103·2**	**Tuberculous.**
30	Red cross . . .	5	101·4	17	101·5	101·9	102·0	101·5	Sound.
31	Shorthorn cross .	7	101·9	20	102·0	101·7	101·8	101·8	Sound.
32	Red cross . . .	12	100·8	18	101·0	101·6	102·2	101·9	**Tuberculous.**
33	Small cross . .	7	102·0	16	**103·7**	**103·9**	**104·1**	**102·5**	**Tuberculous.**
34	White shorthorn	10	101·0	20	101·9	101·7	101·8	101·8	Sound.
35	Black polled . .	6	102·1	18	**104·0**	**104·6**	**104·9**	**103·5**	**Tuberculous.**
36	White horned .	8	100·7	20	**102·3**	**103·0**	**104·2**	**103 5**	**Tuberculous.**
37	Red cross . . .	4	101·4	18	101·3	101·5	101·1	101·1	**Tuberculous.**
38	Black polled . .	11	101·0	20	100·7	100·6	101·1	101·2	Sound.
39	Small Orkney .	10	102·1	17	102·0	102·1	101·9	101·8	Sound.
40	Blue polled . .	12	101·2	18	**104·3**	**105·1**	**103·9**	**102·5**	**Tuberculous.**
41	Black cross . .	10	100·9	20	101·1	101·2	100·9	101·0	Sound.
42	Red horned . .	7	101 8	18	**102·9**	**103·6**	**104·9**	**104·2**	**Tuberculous.**

No. 29. Lungs, pleura, bronchial and mesenteric glands, peritoneum, and udder affected.
No. 32. Lungs and pharyngeal and mesenteric glands affected.
No. 33. Lungs, pleura, and liver affected.
No. 35. Bronchial, mediastinal, and mesenteric glands affected.
No. 36. Nodules in lungs and liver, and left hind quarter of udder affected.
No. 37. Lungs, pleura, bronchial and mediastinal and mesenteric glands, and uterus affected.
No. 40. A few nodules on right lung.
No. 42. Lungs, bronchial and pharyngeal glands affected.

TABLE II.—Conspectus of Post-mortem Results.

Cow No.	Lungs.	Bronchial glands.	Mesenteric glands.	Pleura.	Mediastinal glands	Liver.	Pharyngeal glands.	Peritoneum.	Uterus.	Diaphragm.	Udder.
1	×	×			×						
3	×	×			×						
9	×	×	×								
12	×	×	×	×	×						**X**
13	×										
14	×	×		×							
16	×	×		×				×		×	
17		×									
21		×	×								
22	×	×	×			×					
23	×	×		×							
24		×	×			×					
25	×		×	×			×				**X**
29	×	×	×	×				×			**X**
32	×		×				×				
33	×			×		×					
35		×	×		×						
36	×					×					**X**
37	×	×	×	×	×				×		
40	×										
42	×	×					×				
Totals	17	15	10	8	5	4	3	2	1	1	4

EXPERIMENTAL CONTRIBUTIONS TO THE THEORY OF HEREDITY.

REVERSION AND TELEGONY.[1]

TELEGONY IN THE EQUIDÆ.

By J. COSSAR EWART, M.D., F.R.S., University of Edinburgh.

Introductory.

WHEN, and by whom, it was first suggested that some of the variations met with in the Equidæ are due to the influence of a former mate of the dam, will never be known. But this much is certain that, soon after the horse was domesticated, variation would set in, and, in olden times as now, lead the more thoughtful stockowners to wonder why the offspring sometimes differed so profoundly from their parents. Then as now foals would sometimes more closely resemble a former mate of their dam than their actual sire; then as now, instead of taking after their actual parents, they would sometimes resemble quite a different member of the herd to which they by birth belonged, and thus perchance lead in the one case to the belief in "infection," in the other to the belief in the influence of "maternal impressions." It has been suggested that the Israelites believed in the doctrine of "infection," because, when a man died leaving no issue, his widow was required to marry her deceased husband's brother that he might "raise up seed to his brother." As, however, little would be gained by proving that this hypothesis is as venerable as it is widespread, reference need only be made to the views held as to "infection" during the last two centuries. While it is uncertain whether breeders two centuries ago believed the first mate produced a lasting impression, there is no doubt as to the views of physiologists. Beecher, writing at the close of the seventeenth century, says, "When a mare has had a mule by an ass and afterwards a foal by a horse, there are evidently marks on the foal of the mother having retained some ideas of her former paramour the ass, from which such horses are commended on account of the tolerance and other similar qualities."[2]

The views held by Beecher seem to have prevailed right

[1] Continued from p. 81 of the 'Transactions' for 1901. (Fifth Series, vol. xiii.)
[2] See Sir E. Home's 'Comp. Anat.,' vol. iii. p. 308.

through the eighteenth century, and they gained numerous adherents in all the civilised parts of the world during the nineteenth century, more especially after Lord Morton's account of his quagga experiments was published in 1821 in the 'Philosophical Transactions of the Royal Society.' For a time men of science simply referred to the subsequent offspring taking after a previous mate of their dam as a "curious circumstance"; but by-and-by, without apparently attempting to test by experiment the truth of the assumption, they proceeded to explain the method by which the "infection" was produced. Haller, *e.g.*, suggested that putting a mare to an ass resulted in the female organs being corrupted.[1] Agassiz, as the result of various experiments, came to the conclusion "that the act of fecundation is not an act which is limited in its effect, but that it is an act which affects the whole system, the sexual system especially; and in the sexual system the ovary to be impregnated hereafter is so modified by the first act that later impregnations do not efface that first impression."

Carpenter went a step further, and pointed out that when "infection" occurs, "the blood of the female has imbibed from that of the fœtus through the placental circulation some of the attributes which the latter has derived from its male parent, and that the female may communicate these with those proper to herself to the subsequent offspring of a different male parentage."[2] Others, bearing perhaps in mind Jacob's peeled wands, made use of the doctrine of maternal impressions to account for the resemblance of the subsequent pure-bred offspring to a previous mate of the dam. Sir Everard Home, *e.g.*, regarded the stripes on the colts obtained from Lord Morton's mare after she gave birth to a quagga-hybrid as "one of the strongest proofs of the effects of the mind of the mother upon her young that has ever been recorded."[3]

Mr Herbert Spencer, who assumes telegony has been proved,[4] believes that germ-plasm passes from the developing embryo into the tissues of the parent, to be afterwards incorporated in at least some of the germ-cells as they reach maturity. Weismann, on the other hand, has suggested that if there is such a thing as telegony,—the possibility of which he nowhere disputes,—some of the unused germ-plasm of the first mate penetrates the immature ova as well as the mature one, and eventually takes part in controlling the development of off-

[1] Haller, Elementa Physiologiæ, vol. viii. p. 104.
[2] Human Physiology, 5th edition, p. 826.
[3] Sir E. Home's Comp. Anat., vol. iii. p. 307, 1823.
[4] In the 'Contemporary Review' for April 1893 Spencer says, "On the present occasion space does not admit of giving special instances, so I must ask it to be taken for granted that my evidence is enough to prove the fact of a previous sire asserting his influence on a subsequent progeny."

spring by subsequent mates. There is no evidence that direct infection of this kind ever occurs; but Kollmann[1] and others have recently pointed out that if there is such a thing as telegony, it may be effected indirectly, as suggested by Herbert Spencer, by means of protoplasmic masses finding their way from the fœtal membranes into the circulation of the mother.

During recent years Romanes, Millais,[2] and others, failing to find trustworthy evidence of infection, came to the conclusion that it was a comparatively rare phenomenon; and further, Romanes agreed with Herbert Spencer, that it is most likely to declare itself when the previous mate belongs to quite a different species or variety from the dam.[3]

During recent years men of science have hesitated more and more to accept without reservation the telegony doctrine. On the other hand, breeders (with the exception of Settegast, Nathusius, Kühn, and some others who understood and appreciated scientific methods), as the nineteenth century advanced, became more and more convinced of the truth of the "infection" doctrine. It may, I think, be truly said, that wherever the influence of English breeders prevailed during the second half of the last century the belief in "throwing back to a previous sire" secured a firm footing. Moreover, in many districts it has been assumed not only that sires belonging to a relatively fixed and markedly different stock infect their mates, but also that sires belonging to the same variety or strain —sires which only slightly differ from their mates in colour, make, or temperament—produce a lasting impression. The fact that many now believe a sire conveys characteristics from one mate to another—that, for example, a white shorthorn bull, if transferred from a herd of Galloways to one of his own breed, is liable to beget Galloway-like shorthorns—is sufficient proof of the thorough hold the infection doctrine has now obtained amongst breeders.

Results of Experiments with the Equidæ.

1. *Horse and Ass Experiments.*

During at least the last two centuries it has been asserted times without number that a mare after giving birth to a mule is for at least several years liable to produce tainted offspring, however well bred her subsequent mates. Notwithstanding the repeated assertions, trustworthy evidence in support of the belief

[1] Kollmann, Zeitschrift fur Biologie, Bd. xlii.

[2] Millais, Two Problems of Reproduction. "Our Dogs" Publishing Co., London.

[3] Romanes, An Examination of Weismannism, 1893, Appendix II.

that mares are liable to throw back to a donkey mate is conspicuous by its absence. The sort of evidence that satisfies believers in telegony is well illustrated by the case of the mare Catharine of the Jardin d'Acclimatation, Paris (fig. 53). This mare (because of her long ears) was first said to be a mule; but when she produced fertile offspring with a horse and sterile mules with a donkey, her hybrid nature was no longer insisted on. By-and-by, however, by way of accounting for the long

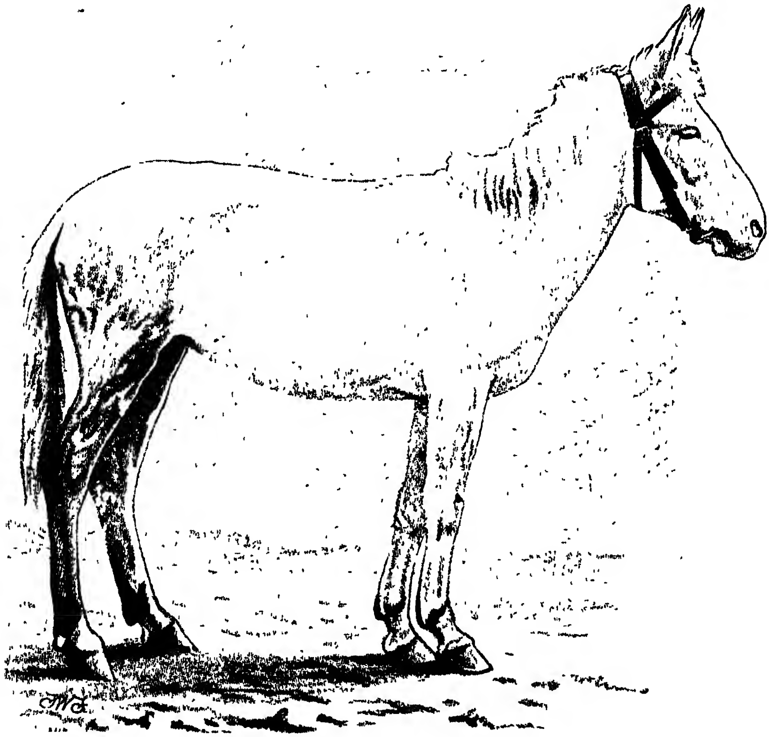

Fig. 53.—"*Catharine*," *of the Jardin d'Acclimatation, Paris.*
From Tegetmeier and Sutherland's 'Horses, Asses, and Mules.'

ears, it was assumed Catharine had thrown back to a previous donkey mate of her dam. All that is known of the history of Catharine is that she was imported from Algeria in 1873. About her ancestors, immediate and remote, absolutely nothing is known. The probability is that in the long ears of this mare we have simply an instance of ordinary variation—at any rate, Catharine cannot be regarded as in any way lending satisfactory support to the doctrine of telegony.

Some years ago a grey New Forest mare, after rearing a mule

(fig. 54), had a foal to my grey Arab Benazrek (fig. 55). This foal at first, partly because of indistinct stripes present at birth, and partly owing to the absence of one of the hind chestnuts and to the hair at the base of the tail being shed with the foal's coat, seemed to lend support to the telegony doctrine. I, however, noticed subsequently that foals by the same Arab horse out of mares that had never seen a donkey, were striped, that the hind chestnuts, though frequently present in mules, are sometimes absent in the horse, and that in many ponies the hair is shed annually from the root of the tail.

Fig. 54.—*A New Forest mare and her mule foal.*

Darwin, who for many years firmly believed the first male influenced the progeny subsequently got by other males, says: "It is worth notice that farmers in South Brazil (as I hear from Fritz Müller) and at the Cape of Good Hope (as I have heard from two trustworthy persons) are convinced that mares which have once borne mules when subsequently put to horses are extremely liable to produce colts striped like a mule;" and adds, "Dr Wilckins, of Pogarth, gives ('Jahrbuch Landswirthschaft,' xi. 1869, p. 325) a striking and analogous case." [1] When a patient after some months special treatment recovers from a lingering disease it is impossible to say how far, if at all, the recovery is due to the medicines administered. Likewise when a mare, after producing a number of mules, gives birth to a striped foal by a sire of her own kind, it is impossible to say to what extent, if at all, the striping is due to the influence of a former mate. In other words, it is impossible to prove that the minute protoplasmic masses (minute doses of the fœtal membranes of the hybrid foal) which reach the blood of a pregnant mare in any way influence the future offspring. The pure-bred foals of thoroughbred mares and of Arabs are sometimes distinctly

[1] Animals and Plants, vol. i., footnote, p. 436.

striped. It is hence not surprising that mares in South America or South Africa, with as a rule but little pedigree to boast of, sometimes have striped offspring. But even were it certain that breeding mules renders a mare extremely liable to subsequently produce striped colts to a horse sire, it by no means follows that the mare has been "infected."

By a long series of experiments I have shown that the characters of the offspring depend to a certain extent on the age,

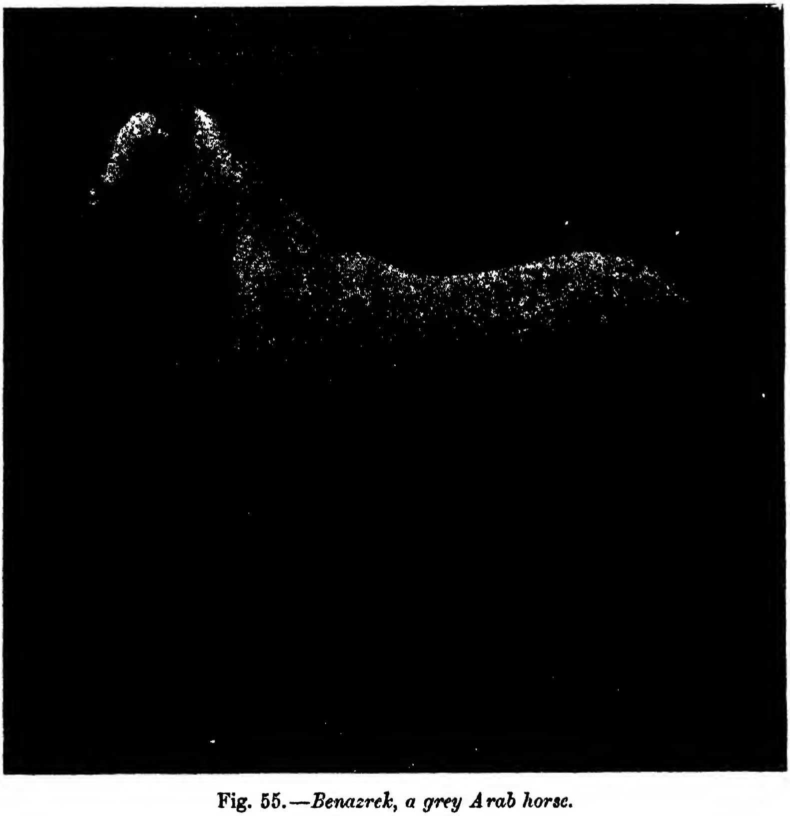

Fig. 55.—*Benazrek, a grey Arab horse.*

condition, &c., of the parents, or, to be more accurate, on the ripeness, vigour, &c., of the germ-cells; that under certain conditions the male parent determines the characters of the offspring, while under others the offspring inherit the characters of the female parent, revert to a recent ancestor, or, at least in size and colour, differ from all known members of the breed. That the impressiveness (prepotency) is a varying quantity is best illustrated by an experiment. A vigorous home-bred half-turbit

pigeon, mated with a blue-rock[1] (suffering from malaria) immediately after a trying journey from India, produced birds like herself. When later the Indian bird got rid of the malaria parasite (*Halteridium*) and was in good feather, a pair of young were reared which can with difficulty be distinguished from pure-bred Indian blue-rocks. While rearing the second pair of young the parents were attacked by the feather parasite (*Goniocotes*[2]). This mite very seriously diminished their vitality. They had, however, vigour enough to hatch and rear a third pair of young; but the birds of the third nest, instead of resembling the blue-rock cock or the reddish-coloured hen, resemble the maternal grandparents, one reproducing fairly accurately the red grandsire, the other the dark jacobin-barb granddam. In this case, to start with, the dam (a cross-bred tame pigeon) was unexpectedly prepotent over a wild blue-rock. On regaining his vigour the blue-rock completely swamped the half-bred turbit; later, when both parents were out of condition, the grandparents surged to the surface, and all but completely controlled the development. Somewhat similar results I have obtained with horses.

As cross-bred animals are, as a rule, unusually vigorous, it is more than likely bringing forth a mule is a greater tax on a mare than producing an ordinary foal. If, as seems probable, there is an intimate relation between the germ-cells and the soma, a mare after giving birth to a mule may be so exhausted that for the time being her impressiveness is lost, with the result that, if mated nine or ten days after the birth of her mule with a non-impressive and not over-vigorous horse, her subsequent foal may present stripes and other ancestral characteristics—*i.e.*, owing to the want of vigour in the parents a more or less remote ancestor may determine the characters of the offspring. But this is not telegony. Moreover, the information from the farmers of South Brazil which reached Darwin through Fritz Müller, as to mares which had borne mules being especially liable to subsequently produce striped colts, is not in harmony with information recently received from Baron de Parana of Brazil. The Baron, who is a highly trained scientific observer as well as an experimental breeder, writes: "I have many relatives and friends who have large establishments for the rearing of mules, where they obtain from 400 to 1000 mules in the year. In all these establishments, after two or three crossings of the mare and ass, the breeders cause the mare to be put to a horse, because they believe that unless the mares are changed after producing three mules they become sterile. In all these estab-

[1] This and a number of other wild blue-rocks were brought from India by Lord Arthur Cecil.

[2] I am indebted to Dr Stewart MacDougall for identifying this parasite.

lishments a pure-bred foal has never been produced resembling either an ass or a mule."

The experience of extensive mule-breeders in other parts of the world exactly agrees with the friends of Baron de Parana in Brazil.[1] It is, in fact, especially in England, where mules are rarely bred and seldom seen, that a mare is believed to be "infected" by bringing forth a mule.

The belief, referred to by Baron de Parana, that mares become sterile if continuously used for mule-breeding, deserves a moment's consideration. That bearing mules induces sterility is extremely unlikely. It is, however, possible that, as already hinted, mules are a heavier tax on the resources of a mare than ordinary foals, and hence sooner than foals lead to a temporary loss of fertility. By periodically changing from a donkey to a horse sire the chance of temporary sterility supervening may be lessened, if not averted.

There is no more evidence that a she-ass is "infected" by bringing forth a hinney than there is that a mare is "corrupted" by giving birth to a mule. A young New Forest donkey, after having in 1898 a hinney foal to a small bay Welsh pony, was put to a white Egyptian jack, with the result that a foal was obtained which in no way suggested the previous (Welsh pony) mate of the dam. Inquiries in Ireland and in other hinney-breeding countries have failed to elicit any evidence in support of the view that the she-ass is liable to be infected when mated with a horse.

2. *Horse and Zebra Experiments.*

(1) *Horse and Quagga* (E. quagga).—Many naturalists have heard of the "royal mares" and of the still more famous "mares of the Prophet," but the mare that especially interests them is Lord Morton's chestnut mare. Times without number it has been related that this mare, after bringing forth in 1816 a quagga hybrid, passed into the hands of Sir Gore Ouseley, Bart., and produced for him between the years 1818 and 1821 three striped foals by a black Arabian stallion. Up to 1820 (when Lord Morton sent his often-quoted letter to the President of the Royal Society), though the belief in the infection hypothesis was widely held by physiologists, the evidence on which it rested was hardly convincing. Lord Morton's communication was thus most welcome, and henceforth when any one questioned the truth of the infection doctrine it was considered sufficient to refer the doubter to the famous letter in the 1821 'Philosophical Transactions.' This letter has been so often

[1] Sweepstakes, *e.g.*, produced Star Pointer and other great pacers after bringing forth a couple of mules.

referred to, and, if one may judge by the numerous misquotations, seldom seen, that I give it verbatim. It is as follows :—

"MY DEAR SIR,—I yesterday had an opportunity of observing a singular fact in natural history, which you may perhaps deem not unworthy of being communicated to the Royal Society.

"Some years ago I was desirous of trying the experiment of domesticating the quagga, and endeavoured to procure some individuals of that species. I obtained a male; but being disappointed of a female, I tried to breed from the male quagga and a young chestnut mare of seven-eighths Arabian blood, and which had never been bred from. The result was the production of a female hybrid, now five years old, and bearing, both in her form and in her colour, very decided indications of her mixed origin. I subsequently parted with the seven-eighths Arabian mare to Sir Gore Ouseley, who has bred from her by a very fine black Arabian horse. I yesterday morning examined the produce—namely, a two-year-old filly and a year-old colt. They have the character of the Arabian breed as decidedly as can be expected where fifteen-sixteenths of the blood are Arabian, and they are fine specimens of that breed; but, both in their colour and in the hair of their manes, they have a striking resemblance to the quagga. Their colour is bay, marked more or less like the quagga in a darker tint. Both are distinguished by the dark line along the ridge of the back, the dark stripes across the fore-hand, and the dark bars across the back part of the legs. The stripes across the fore-hand of the colt are confined to the withers, and to the part of the neck next to them. Those on the filly cover nearly the whole of the neck, and the back as far as the flanks. The colour of her coat on the neck adjoining to the mane is pale, and approaching to dun, rendering the stripes there more conspicuous than those on the colt. The same pale tint appears in a less degree on the rump; and in this circumstance of the dun tint also she resembles the quagga. The colt and filly were taken up from grass for my inspection, and, owing to the present state of their coats, I could not ascertain whether they bear any indications of the spots on the rump, the dark pasterns, or the narrow stripes on the forehead, with which the quagga is marked. They have no appearance of the dark line along the belly, or of the white tufts on the sides of the mane. Both their manes are black; that of the filly is short, stiff, and stands upright, and Sir Gore Ouseley's stud-groom alleged that it never was otherwise. That of the colt is long, but so stiff as to arch upwards and to hang clear of the sides of the neck, in which circumstance it resembles that of the hybrid. This is the more remarkable, as the manes of the

Arabian breed hang lank, and closer to the neck than those of most others. The bars across the legs, both of the hybrid and of the colt and filly, are more strongly defined, and darker than those on the legs of the quagga, which are very slightly marked; and though the hybrid has several quagga marks, which the colt and filly have not, yet the most striking—namely, the stripes on the fore-hand—are fewer and less apparent than those on the colt and filly. These circumstances may appear singular; but I think you will agree with me that they are trifles compared with the extraordinary fact of so many striking features, which do not belong to the dam, being in two successive instances communicated through her to the progeny, not only of another sire, who also has them not, but of a sire belonging probably to another species, for such we have very strong reason for supposing the quagga to be.—I am, my dear sir, your faithful humble servant,

"MORTON.

"DR W. H. WOLLASTON.

"*P.S.*—I have requested Sir Gore Ouseley to send me some specimens of hair from the manes of the sire, dam, colt, and filly; and I shall write to Scotland[1] for specimens from those of the quagga and of the hybrid.

"I am not apt to build hypotheses in a hurry, and have no predilection either for or against the old doctrine of impressions produced by the imagination; but I can hardly suppose that the imagination could pass by the white tufts on the quagga's mane and attach itself to the coarseness of its hair.

"WIMPOLE STREET, *August* 12*th*, 1820."

In addition to the information contained in this letter we have preserved in the Royal College of Surgeons' Museum, London, drawings by Agassé[2] of the chestnut mare, her first mate the quagga, her first foal the quagga hybrid, her second mate the black Arabian, and the three colts she produced to him. With few exceptions, naturalists, physiologists, and breeders from 1821 onwards (apparently in most cases without examining Agassé's drawings) were convinced by Lord Morton's letter of the fact of telegony. Darwin, *e.g.*, wrote, "There can be no doubt that the quagga affected the character of the offspring subsequently got by the black Arabian horse."[3] The two most notable exceptions were Weismann and Settegast.

[1] The quagga hybrid was bred at Dalmahoy, Lord Morton's seat, near Edinburgh.

[2] Agassé, Sir Walter Gilbey informs me, was one of the most reliable and distinguished animal-painters of the early part of the nineteenth century.

[3] Animals and Plants, vol. i. p. 435.

Weismann, writing in 1893, says: "I do not dispute the possibility of telegony: I grant that the wide general acceptance of the belief in the past has so far impressed me that I have always said that possibly it might be justifiable and founded on fact. I should accept a case like that of Lord Morton's mare as satisfactory evidence if it were quite beyond doubt. But that is by no means the case, as Settegast has abundantly proved."[1] Settegast had previously pointed out that in Agassé's drawings there is no resemblance in the colts (by the Arabian horse) to the quagga beyond the stripes.

Fig. 56.—*Lord Morton's quagga.*

After Agassé's drawing in the Royal College of Surgeons' Museum, London.

The quagga (fig. 56) used by Lord Morton seems to have been in every way a typical specimen of a now extinct species. As in the true Burchell zebra (fig. 77), the leg bars were "very slightly marked;"—these markings seem to have completely vanished before the drawing was made in 1821.

The chestnut mare is described as young, and of seven-eighths Arabian blood. Recently I was fortunate enough to learn that this famous mare was purchased in India and presented to Lord Morton (when serving in India) by one of his officers.

From the shape of the ears, the mare may very well have been

[1] Contemporary Review, vol. lxiv.

a cross between an Arab and a Kattiawar pony. I may mention that in Kattiawar the native horses, asses, and other ungulates are usually of a rufous-grey or khaki colour. At one time the Kattiawar, like the Norwegian ponies, were not considered pure unless decorated with a dorsal band, and bars across the legs; sometimes in addition there were stripes on the neck, withers, and forehead.[1]

The hybrid (fig. 57), which seems to have been in make more a horse than a quagga, had fewer stripes than often occur in ordinary mules and in dun-coloured Eastern and Norwegian ponies. Moreover, the stripes in the figure, with the exception of three across the withers, are limited to the legs.

It is especially worthy of note that the hair of the mane in the hybrid was short but not erect,—Agassé represents it as falling to both sides of the neck,—while the hair of the proximal part of the tail seems to have been shorter than that of the mane. Judging by the make, the paucity of stripes, and the condition of the mane, it may be assumed that the chestnut dam was far more prepotent than the quagga sire.

Of the black Arabian stallion nothing is known. But it may be mentioned that on the Continent the offspring of black sires saturated with Arab blood are often more or less distinctly striped, just as the offspring of black West Highland ponies are often striped.

Of the three foals produced by the chestnut mare to the black Arabian horse only the eldest, a filly born in 1818 and examined by Lord Morton in August 1820, need be referred to. According to Lord Morton, this filly (fig. 58) was Arab-like in make, of a bay colour, "marked more or less like the quagga in a darker tint," the neck, however, adjoining the mane and, to a less degree, the rump approaching a dun tint. The markings included a dorsal band, ill-defined stripes along the greater part of the neck, and also on the trunk as far as the flanks, and dark bars across the back part of the legs. Thus far Lord Morton's account is confirmed by Agassé's drawing (fig. 58); but it may at once be said that neither the colour nor the markings[2] of the filly prove that her dam, the chestnut mare, had been "infected" by her first mate, the quagga. Pure Arabs are sometimes of a dun colour,[3] and Indian-Arab crosses are in their coat-colour some-

[1] At the present day Kattiawar ponies are regarded as pure-bred though of a chestnut colour.

[2] The markings are somewhat exaggerated in fig. 58. In a photograph from Agassé's drawing they are practically indistinguishable.

[3] I have had two Arabs under observation for some time (one a roan bred by Mr Wilfrid Scawen Blunt, the other a bay brought from India by Lord Arthur Cecil), in each of which there is a distinct dorsal band and bars in the vicinity of the "knees" and hocks; both have in addition indistinct markings across the withers.

times decidedly lighter than the quagga. In a cross between an Arab and a Kattiawar pony, imported last year from India by Lord Arthur Cecil, the coat is lighter in colour than that of my zebra Matopo.

Fig. 57.—*Quagga ♂-horse ♀ hybrid, bred by Lord Morton.*

Moreover, in the west of Ireland, where, as in India, ancient breeds of ponies are still represented, chestnuts not infrequently produce light duns, and sometimes a black pony is seen with a

yellow-dun foal.[7] Hermit, a yellow-dun polo-pony stallion, is out of a grey mare (Sybil), by a black stallion (The Monk).

It might be said that while the coat-colour of the filly is in itself inconclusive, the colour taken along with the stripes practi-

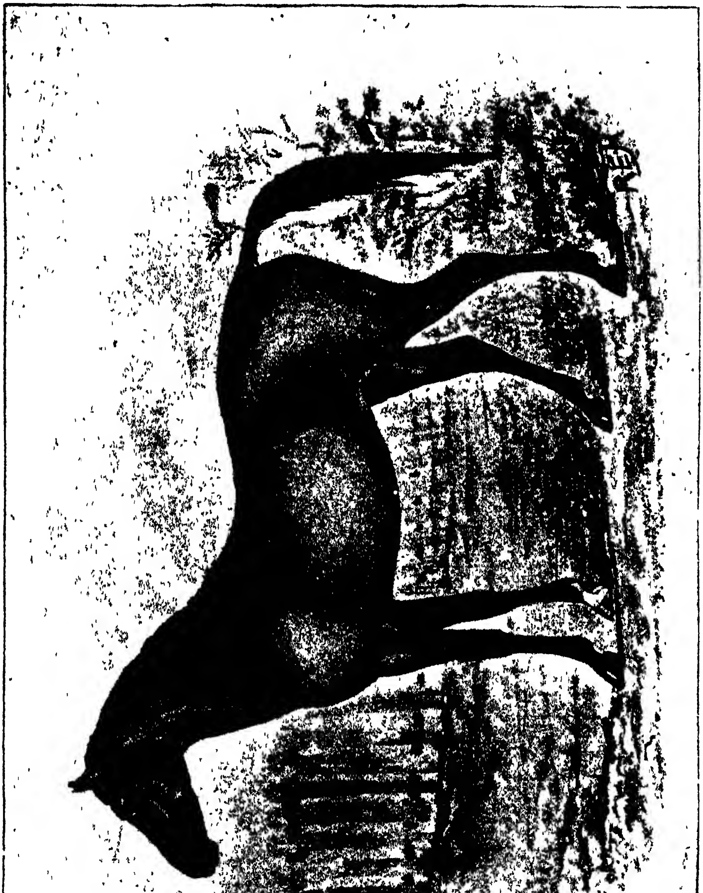

Fig. 58.—*Filly by a black Arabian horse out of a chestnut mare after she gave birth to a quagga hybrid.* After Agassé.

cally amounts to proof of "infection." The presence of so many stripes on the filly is certainly remarkable; but seeing that stripes are so frequently seen on cross-bred ponies, especially

when of a dun colour, the numerous indistinct markings on the filly can only be regarded as a coincidence. In Tibet and Norway, and other isolated areas into which neither quaggas nor zebras have ever penetrated, ponies are frequently seen far more richly and more distinctly striped than the filly in question. Had the chestnut mare produced a whole-coloured foal quite destitute of stripes before being mated with the quagga, the stripes on the foal born two years after the arrival of the quagga-hybrid would have deserved more serious consideration. As it is, they entirely fail to establish the fact of telegony.

Hitherto it has been generally assumed that it is impossible to gainsay the evidence afforded by the mane in the colt and filly. Lord Morton said of the mane of the filly that it is "short, stiff, and stands upright"; and he adds, "Sir Gore Ouseley's stud-groom alleged that it was never otherwise." The mane of the colt is described as long, "but so stiff as to arch upwards and to hang clear of the sides of the neck."

The account given by Lord Morton is vouched for by Dr Wollaston, President in 1820 of the Royal Society. Dr Wollaston says he had the "opportunity of seeing the mare, the Arabian horse, the filly, and the colt, and of witnessing how correctly they agreed with the description given of them by Lord Morton." [1]

There is, however, complete want of agreement between Lord Morton's description of the filly's mane and Agassé's drawing in the Royal College of Surgeons. The mane of the filly, instead of being represented by Agassé as short and upright, is figured as lying entirely on the right side of the neck (fig. 58).

How is it possible to reconcile Agassé's drawing with Lord Morton's description? Simply by saying that between August 1820, when Lord Morton inspected the colts, and the summer of 1821, when Agassé sketched them, the mane in the filly had sufficiently increased in length to hang to one side of the neck. But if this is admitted, the statement by the stud-groom, to the effect that the mane in the filly had from the first been short, stiff, and upright, cannot be maintained, and in consequence of this, what at first sight appeared conclusive evidence of "infection" is robbed of all its value.

The mane of the quagga hybrid is described by Lord Morton as arching upwards, clear of the neck. This description agrees with Agassé's drawing (fig. 58).

In the horse the hairs of the mane, or the majority of them, may persist for years growing at the rate of about 1 inch per month during at least nine months of the year. In most cases, after reaching a certain length, the hairs of the mane one by one fall out, but in other cases the majority persist until they reach

[1] Phil. Trans., 1821, p. 20.

a length of several feet: sometimes the mane of the horse, like the beard of man, is over 12 feet in length.

In zebras the hairs of the mane (fig. 61), when they reach a length of from 4 to 6 inches, stop growing, and after a time fall out, the old giving place to the new so gradually that the process often passes unnoticed.

In zebra hybrids, as in zebras, the whole mane is shed annually; but as the hairs are frequently from 8 to 10 inches in length, and as some parts are often shed before others, the process of renewal is quite obvious. In fig. 59 the new mane is short and upright, while the previous year's mane is represented by tufts of long hair, arching some to the right side some to the left of the neck. From a zebra hybrid, in which the hairs at the middle of the neck reached a length of 9 inches, the mane was completely removed in April 1901. Six months afterwards the mane had reached a length of 5 inches, and was (as in an Arab similarly treated in 1900) short, stiff, and upright; nine months later the mane at the middle of the neck—being already from 8½ to 9 inches in length—arched to one side. After reaching a length of 10 or at most 11 inches, the mane will again be shed. In the Arab with the hogged mane, it gradually increased in length until it was long enough to cling to the neck.

Fig. 59.—*Norette, a zebra ♂-Shetland pony ♀ hybrid, showing the mane in process of shedding.*

If in Lord Morton's quagga hybrid the mane arched to one side, and if in zebra hybrids it invariably, during part of the year, falls to one or both sides of the neck, it is *a priori* extremely unlikely that in the filly the mane, as alleged by the stud-groom, had been from the first short, stiff, and upright.

There is yet another reason for rejecting as incredible the

statement of the stud-groom. In the Equidæ there is invariably an intimate relation between the mane and the tail. In my four-year-old Arab mare Fatimah the tail, apart from the hair, measures from base to tip 16 inches. The terminal 5 inches of the dock carries hair from 36 to 40 inches in length. For 2½ inches at the root of the tail the hair resembles, and is but little longer than, the body hair, while the hair on the intermediate portion (8½ inches), though stronger, resembles the hair of the mane—hair taken 6 inches from the base of the tail measuring, like the hair in the middle of the mane, from 18 to 19 inches. Moreover, in the horse the hair at the root of the tail changes with the coat, while the hair at the intermediate portion, like the hair of the mane, often reaches a considerable length.

In hybrids the dock is always relatively long. In a 14-hands three-year-old thoroughbred colt the dock measures 16 inches, while in a hybrid of the same age and size it measures 20 inches.[1] The hair is arranged in hybrids as in the horse; the tip carries long strong hairs,—in a three-year-old 14-hands hybrid they measure 30 inches,—the base short hairs identical with those of the body, the intermediate portion hairs like those in the mane but shorter (half-way down the dock they only measure 6 inches) and somewhat coarser. The hairs of the intermediate portion, like the mane hairs, are shed annually. As to the hairs of the intermediate part of the tail, it is worth mentioning that in hybrids they are never as long as the hairs of the mane.

In describing the filly and colt, Lord Morton makes no mention of the tail; but in Agassé's drawings, while the upper third of the tail in the hybrid is figured as being deficient of long hairs, the tail of the colt and filly is the tail of a horse—it in no way differs from the tail of the Arab sire or the chestnut dam. With an Arab-like tail it is inconceivable the filly could have a zebra-like mane. There hence seems no escape from the conclusion that some time prior to the visit of Lord Morton in 1820 the mane of the filly (unknown to the stud-groom) had been hogged. Judging by what happened in the Arab above referred to, there was sufficient time between the autumn of 1820 and the summer of 1821, when the drawings were made, for the upright mane in the filly to grow into a mane long enough to fall to one side, as represented by Agassé. If, as the drawing shows, and a consideration of the mane and tail in the horse and in zebra-horse hybrids strongly suggests, the mane of the filly in no way differed from that of her dam, it can no

[1] In Phenacodus, the supposed remote ancestor of the Equidæ, the tail (dock) was longer than the hind-legs; if one may judge by young horse embryos, the tail in the remote ancestors of the horse had only a tuft of hair at the tip, such as occurs in the lion.

longer be maintained that (as Darwin [1] and so many before and since his day believed) Lord Morton's "quagga affected the character of the offspring subsequently got by the black Arabian horse." [2]

In Darwin's exhaustive work on 'Animals and Plants under Domestication' yet another mare is said to have been influenced by a quagga. This mare, the property of Lord Mostyn, after having a quagga hybrid had a dun-coloured foal with a dorsal band, bars on the legs, faint markings on the forehead—over which the mane extended to an unusual extent—and elongated hoofs.[3] Nothing is said as to the breed of either the sire or dam of this dun-coloured foal. The colour and markings suggest reversion rather than infection. As it happens, I had for two years a yellow-dun Norwegian pony which only differed from Lord Mostyn's foal in that it had very distinct narrow markings on the forehead (fig. 60). As to the hoofs, it ought to be mentioned that in the quagga the hoofs were actually shorter than in some high-caste Arabs: the quagga could hence hardly be credited with the elongation of the hoofs in Lord Mostyn's foal.

Fig. 60.—*Face of a yellow-dun Norwegian pony with zebra-like markings.*

[1] Mr Sutherland (joint-author with Mr Tegetmeier of 'Horses, Asses, and Zebras') informed me when last at Down that Mr Darwin for some years before his death had doubts about the validity of the doctrine of "infection."

[2] The suggestive results obtained by Lord Morton and Sir Gore Ouseley were, as is often the case, not the outcome of carefully designed experiments. This may account for no attempt having been made to control them. Had the black Arabian been put to other mares—bay as well as chestnut—which had never seen a quagga, he might have begotten striped offspring.

[3] Animals and Plants, vol. i. p. 435.

(2) *Horse and Burchell Zebra* (E. burchelli) *Experiments.*—It will, I think, be generally admitted that the "infection" doctrine has still devoted adherents in all parts of the world largely because of the publication in 1821 of Lord Morton's letter, and that but for Lord Morton's mare the "infection" hypothesis would ere now have been as completely ignored by men of science as the legend of the barnacle-tree.

Being aware when, in 1895, I started my investigations that, influenced by the Morton-Ouseley results, not only breeders but

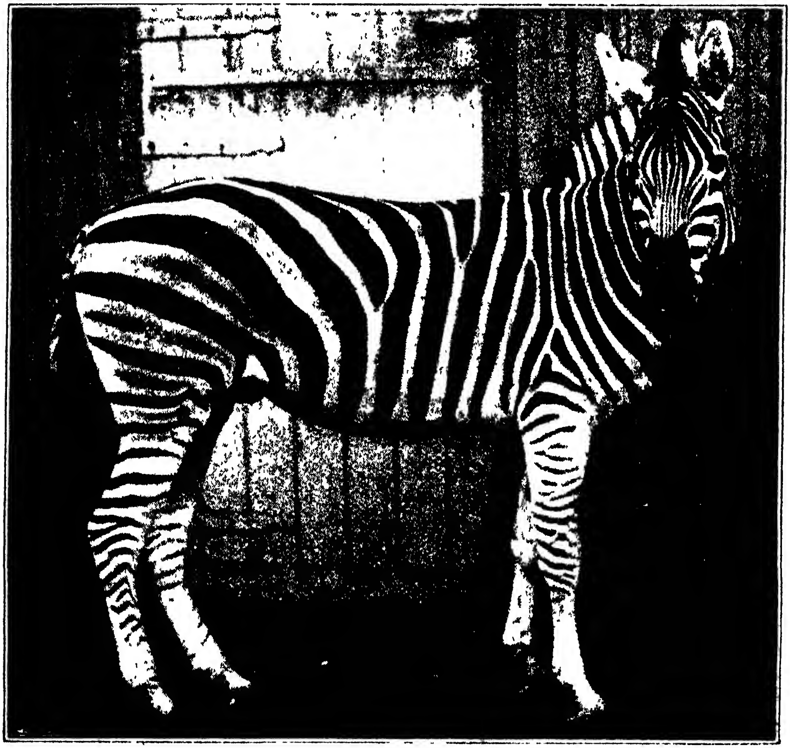

Fig. 61.—*Matopo, the Burchell zebra, used in the telegony experiments.*

many physiologists were firmly convinced of the truth of telegony, I thought it advisable to make arrangements for a fairly extensive series of experiments with members of the Equidæ group. The quagga being extinct, I at the outset purchased three Burchell zebras—a stallion and two mares—and an Arab stallion; later I got together a troop of mares in which all the more important breeds and the more familiar colours were represented. The zebra stallion (Matopo), as fig. 61 shows, is a

handsome richly decorated member of the Chapman variety of the great Burchell group. Unlike Lord Morton's quagga, Matopo has proved a highly impressive sire—even endowing his offspring out of thoroughbred mares with numerous distinct stripes. Though figs. 44,[1] 49,[1] and 61 sufficiently indicate the arrangement of the stripes in Matopo, it may be well to direct special attention to the fact that the lower brow-markings (fig. 44 [1]) consist of a series of pointed arches, one within the

Fig. 62.—*Skin of a mountain zebra to show the "gridiron" over the croup.*

other; that there are only five vertical bands behind the shoulder stripe, while five broad stripes run obliquely over the flank and hind-quarters (fig. 61); that the legs are not barred to the hoofs; and further, unlike the imperial zebra (*E. grevii*), there is a complete absence of stripes across the croup—*i.e.*, of the stripes which form the characteristic "gridiron" (fig. 62) of the mountain zebra (*E. zebra*).

[1] Transactions for 1901, pp. 125, 130.

Matopo mainly differs from the domestic horse in having an upright mane, short hair on the upper part of the tail,—which, notwithstanding the well-formed hind-quarters, is set on somewhat low,—elongated hoofs, the "chestnuts" limited to the forelegs, and the ears large and rounded at the tip. The mane, which consists of a thick black mesial part, and black and white tufts at each side, is always upright, because the hair, even in the middle of the neck, never exceeds a length of 5 inches. Unlike the horse, the hair in the zebra's mane, instead of persisting for years, is shed annually, the new hairs, as already stated, taking the place of the old so gradually during summer that the process often passes unnoticed. The dock of the tail measures 21 inches: it is hence relatively longer than in the horse. The hair, moreover, on its upper third is short and similar to the body hair. On the middle third the hair, though only from 2 to 3 inches in length, resembles that of the mane, and, as in the case of the mane, it is deciduous. As in the horse, the end of the dock carries long hairs.

In the horse the wall of the hoof (*i.e.*, the part corresponding to the nail in man), after arching outwards, curves sharply inwards at each side posteriorly, so as to grip, as in a vice, the back part of the frog (which corresponds to the soft tip of the middle digit in man and to the horny pad under the third toe in the dog). Over the incurved portions of the hoof-wall the frog extends some distance outwards, and thus partly covers the so-called "heels" of the hoof.

In the zebra the hoof-wall (fig. 63), instead of curving inwards posteriorly, simply extends backwards at each side of the triangular-shaped frog, thus forming with the frog a wide nearly flat surface, largely concerned in supporting the weight of the animal. Because of the great width of the frog posteriorly and of the backward elongation of the hoof-walls, zebras, like asses, often appear to be "down on their heels." It need only be further added that there is but a very shallow cleft along the centre of the frog, and that, instead of extending a considerable distance over the incurved hoof-walls—*i.e.*, over the heels—the frog simply fills up the triangular space between them (fig. 63).

The chestnuts, large (they are 3 inches in length in Matopo), smooth, black structures on a level with the surface of the skin, are (as in the ass) nearer the elbow than in the horse. The outermost layer of the chestnut is shed annually.

The action of Matopo is quite characteristic but difficult to describe. In the kiang (*E. hemionus*) of Tibet the action is often very striking—apparently as extravagant as in some hackneys,—but in Matopo there is little knee-action: the fetlock-joints, however, move freely,—probably the free action

at the fetlock is necessitated by the elongation of the heels and the peculiar form of the frog. At the gallop the thrust is considerable, and at both the trot and the gallop there seems to be very little waste of energy.

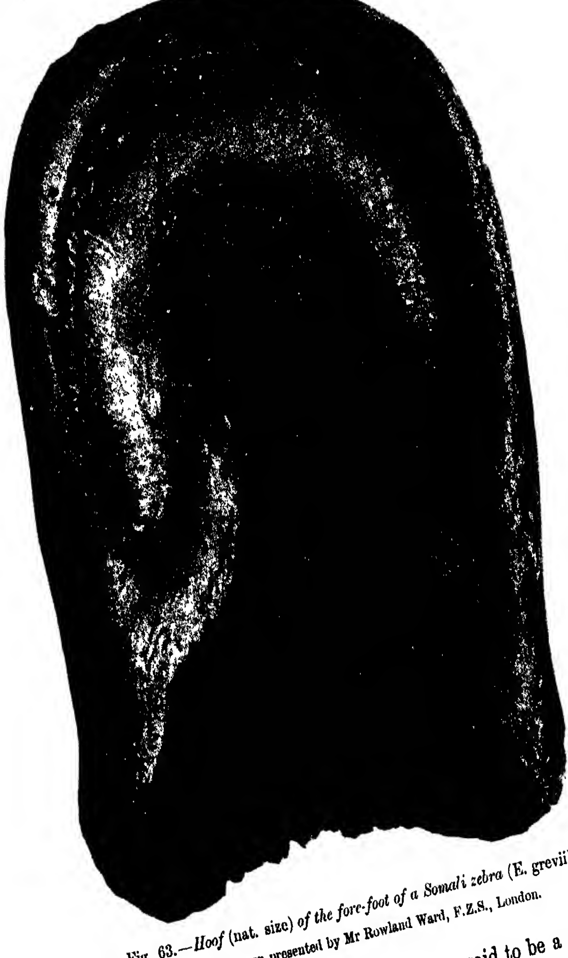

Fig. 63.—*Hoof* (nat. size) *of the fore-foot of a Somali zebra* (E. grevii).
From a specimen presented by Mr Rowland Ward, F.Z.S., London.

As to mental characters, Matopo may be said to be a unique mixture of curiosity, caution, and alertness. For some time

after his arrival from Antwerp—doubtless because all his surroundings were strange—he was restless, and generally behaved like a wild animal suddenly robbed of his freedom. He rushed about his box more like a tiger than a striped horse, uttering often his far-sounding bark-like call, and apparently prepared to savage every one who came within his reach. Now, though in excellent condition, he is quite friendly and free from vice. Nevertheless, he is still as curious as ever, as alarmed as ever with new and unfamiliar objects, and as rapid at wheeling round and jumping into the gallop when suddenly startled. As the domestic horse when alone often behaves as if he expected the onslaught of his old enemy the wolf, the zebra frequently seems to dread an attack from his still very real enemy the lion. If for countless ages those individuals fared best—lived longest and left most descendants—which responded quickest and most intelligently to stimuli that led to life-saving action —*i.e.*, to movements which secured their escape from their arch-enemy the lion—there is little difficulty in understanding the behaviour of zebras when unusually excited. Zebras, at least during summer, require to quench their thirst daily. This often means running the risk of encountering lions at or near the water-holes. Hence the careful scouting, the cautious approach, the hurried retreat on the slightest alarm,—at the breaking of a twig or the flutter of a wing,—the hurried deep draught when the water is reached, and the often playful return from an expedition which might very well have had a tragic ending. The points and character of Matopo, the "previous mate," having been sufficiently referred to, the mares put to him, their hybrids and subsequent offspring, may next be considered.

(a) *Results of Experiments with Chestnut Mares.*

Lord Morton's seven-eighths Arabian being of a chestnut colour, I was careful to select a number of chestnut mares for my experiments. As, however, stripes are believed to be latent in black horses, I decided to use grey, chestnut, and bay horses, instead of a black Arabian stallion.

Of four chestnut mares only one proved useful. A three-year-old by Petrarch, though she deigned to gambol with a zebra filly, would have nothing to say to the zebra stallion. This was partly because, like so many thoroughbreds, she was extremely sensitive, partly perhaps because she was entirely devoted to my grey Arab horse Benazrek. A hunter chestnut mare unfortunately "picked" her hybrid foal and was of no further use, while a young chestnut hackney mare proved sterile. The fourth mare (Valda), of nearly the same colour as

Lord Morton's and at least seven-eighths thoroughbred, proved as quiet and even-tempered as Petrarch's filly was restless and uncertain; probably for this reason she bred readily with the zebra. In 1898 Valda had twin hybrids by Matopo, in 1899 a foal by a light chestnut thoroughbred (Lockstitch), in 1900 a third hybrid by Matopo, in 1901 a foal by a dark chestnut thoroughbred (Diplomat).

It has hitherto been assumed that the wild type prevails over the tame, the old species over the new. This, however, can hardly be said to be the case when the horse and zebra are crossed; for, as already seen, Lord Morton's quagga hybrid had

Fig. 64.—*A pony ♂-zebra ♀ hybrid bred by Lady Meux.*

fewer stripes than many dun-coloured ponies, fewer than in his near but purer-bred relatives by the black Arabian.

Again, some Burchell zebra hybrids might almost pass for dun-coloured ponies—*e.g.*, the hybrid represented in fig. 64 is but faintly marked, and in many ways is more suggestive of her sire (fig. 65) than of her zebra dam.

Valda's twin hybrid, Nestor, takes about equally after both parents, while her 1900 hybrid (Birgus), though richly and distinctly striped, probably resembles in make his maternal ancestors. We thus have in Birgus a remarkable blending of two highly specialised species.

Valda (fig. 66), once a clever polo-pony, is "pigeon-breasted," has high fine withers, long flexible pasterns, and well-let-down good hocks. She has neither a dorsal band nor bars across the legs. Her twins (of which only one, the colt, survives) were faintly marked; but in her 1900 hybrid, Birgus (fig. 66), the stripes were at first nearly as distinct as in some of the zebras, but now that the body colour has assumed a chestnut (leather-dun) tint they are not quite so conspicuous.

The stripes are nearly twice as numerous in these hybrids as in their zebra sire.[1] The frontal stripes are in the form of narrow arches, while over the croup transverse, but not very

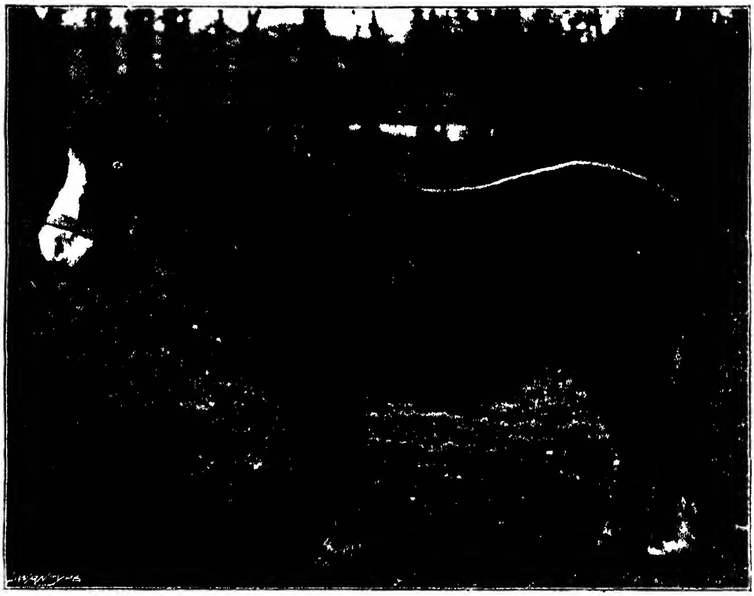

Fig. 65.—*Sire of the hybrid represented in fig.* 64.

distinct, markings form an imperfect "gridiron." In having the neck stripes more distinct at birth than the body markings, Birgus agrees with new-born imperial zebras, while in having nine vertical bands behind the shoulder stripe he agrees with the mountain zebra (fig. 62), and, when the shadow stripes are included, with some of the Burchell zebras (fig. 77). In the croup markings he is intermediate between the mountain and imperial zebra, while in the brow markings he is nearly intermediate between the imperial and Crawshay's zebra—a variety of the Burchell species. It thus appears that, as so frequently

[1] This probably indicates that Matopo is highly specialised in his markings.

Fig. 66.—*Valda, a chestnut polo pony, and her hybrid foal Birgus.*

happens in pigeons, the crossing of two distinct forms has led to the reappearance of a number of ancestral markings, probably because old and more fixed characters are more easily produced in cross-bred animals than recently evolved characters.

The mane of the hybrids during winter is nearly double the length of the mane in Matopo, and hence falls to one side; but, as in all the zebras, and unlike all the breeds of the domestic horse, owing to its being renewed annually, it is short and upright during summer. The hair of the mane in shape and minute structure agrees more closely with that of the imperial zebra than with that of the Burchell zebra sire or the chestnut dam; the body hair, however, approximates in structure to that of the sire.[1] The hair of the upper two-thirds of the tail in the hybrids is coarse and wiry, and on an average twice the length of the hair on the corresponding position of their sire: as in the sire, it is shed annually. The long hair—20 inches in the two-year-old and 30 inches in the three-year-old—growing from the end of the dock is coarse and wiry, like the long tail-hairs in the zebra.

The legs and hoofs in the hybrids are decidedly zebra-like. Though the legs look very fine, they measure as much (6 inches) below the "knee" in Birgus as in a half-Arab filly of the same size and age. The chestnuts in the fore-legs are relatively larger and nearer the elbow than in the horse, but not so far from the "knee" as in the zebra. In the three-year-old hybrid the chestnuts are absent from the hind-legs; but in Birgus they are as large and prominent as in his companion the two-year-old half-Arab—the right measures 1 inch by $\frac{5}{8}$ inch, the left $\frac{3}{4}$ inch by $\frac{1}{2}$ inch.[2] The hoofs, though zebra-like in shape, are nearly intermediate in structure,—the hoof-walls, *e.g.*, bend in slightly, and are partly invested posteriorly by the frog. Further, the frog is relatively narrow, and presents, as in the horse, a distinct mesial cleft. When in harness the twin hybrid moves not unlike a thoroughbred; but when rushing about in a field he suggests a stag more than anything else. Like the zebra, he turns quickly.

I have never known a member of the horse family so tame and friendly as Valda's eldest hybrid. Like most of the hybrids, he has from the first courted attention. This is also true of the two-year-old Birgus. Since he was four months old he has had as companion a half-Arab filly. The filly, a "subsequent" foal, even in the loose-box objects to be noticed, and

[1] For an account of the hair of zebras, zebra hybrids, &c., see paper by F. H. A. Marshall, B.A., Proceedings, Royal Society of Edinburgh, vol. xxiii.

[2] In having a nearly upright mane, short hair on the upper two-thirds of the dock, and chestnuts on the hind-legs, Birgus agrees with Prevalsky's horse, and thus supports the view of some naturalists, that the wild horse of the Gobi Desert may be a hybrid between the horse and kiang.

always keeps apart in the field; the hybrid, on the other hand, invariably comes forward, and never resents free handling. Though the four-year-old has many of the traits of his wild sire, he was easily broken to both saddle and harness.

The behaviour of the twin hybrid and of a zebra filly I had some years ago leads one to wonder whether, had the men of the later Stone Age had the option, they would not have selected for domestication the zebra in preference to the horse. Though these hybrids are neither nervous nor irritable, they are apt to be upset by entirely new surroundings, especially if separated from their wonted companions. In other words, they have far more strongly developed than thoroughbreds and other highly domesticated breeds the life-saving instincts so requisite in a wild state—instincts which in our ignorance we often regard as incurable vices.

If one may judge by the results obtained at *ateliers* in Poitou, zebra hybrids are more easily reared, and hardier—not to say more handsome—than ordinary mules. During the present winter two yearlings and quite a number of older hybrids have been out night and day—at the end of the three weeks' severe weather in December they looked quite as fit as before the snowstorm set in.

The only other facts that need now be mentioned as to the hybrids are—(1) that the ears are usually as long as in the zebra, but more pointed; (2) that the upper eyelashes are long and curved; (3) that the nostrils, though narrow as in zebras, are capable of expanding into prominent trumpets; (4) that the call neither suggests the barking sound of the zebra nor the neigh of the horse; and (5) that a few minutes after birth they are, as a rule, ready to follow their dam, and, far sooner than ordinary foals, distinguish their respective mothers from other members of the herd: in other words, from the first they are, with rare exceptions, unusually active and intelligent, and as responsive to all kinds of stimuli as a new-born zebra.

Having pointed out the more important characters of the zebra Matopo, and of some of his hybrid offspring, the question may now be asked, Does Valda's foal by the light chestnut horse Lockstitch, or her foal by the dark chestnut Diplomat, afford any support to the doctrine of infection?

The twin hybrids were born on the 31st May 1898. On the 9th June Valda was again put to Matopo, but failing to hold, she was put on the 30th June to Lockstitch. On the 31st May 1899 her foal (Hector) by Lockstitch arrived. On the 9th June 1899 Valda was again put to Matopo, and she gave birth to her third hybrid (Birgus) on the 12th May 1900. On the 21st May she was once more put to Matopo; but breaking service at the end of the sixth week, she was put to Diplomat on the

26th July, and foaled 16th June 1901. Valda has hence had unusual chances of having her germ-cells infected—indirectly through her three hybrids, directly by male germ-cells reaching the ovary twenty-one days before she was put to Lockstitch, and again sixty-six days before she was put to Diplomat.

Although Valda's foal (fig. 67) by Lockstitch has been under constant observation since his birth, neither in his colour, make,

Fig. 67.—*Hector (as a yearling), Valda's foal by Lockstitch, born the year after twin hybrids.*

nor disposition has he ever in any way either suggested the previous mate of his dam or his hybrid half-brothers. The same is true of the foal by Diplomat.

As a control experiment, Solway Maid, a chestnut mare[1] by Friar Rush, was put to Lockstitch in 1897. Her foal, born July

[1] This mare is quite as well bred as Valda, and as closely resembles in colour Lord Morton's seven-eighths Arabian.

1, 1898, has been kept under constant observation, and notes made of the rate of growth, disposition, &c. This foal, though larger (his dam was a hand taller than Valda), in make, colour, and temperament is extremely like Valda's Lockstitch foal.

Valda's two foals and Solway Maid's foal are all of the same shade of chestnut. In Valda's three-year-old the mane (nearly upright at birth) consists of fine hair, from 14 to 16 inches in length at the middle of the neck, while the hair of the middle part of the tail is of nearly the same length as the hair of the mane. The chestnuts are of the same form as in the dam, while the hoofs, instead of being elongated, are in the meantime relatively nearly one-third shorter than in the dam, and they are decidedly shorter than were the hoofs of Solway Maid's foal at the same age. Hector has relatively a shorter back and higher withers than either his parents or Solway Maid's foal, and his action is that of a daisy-cutting thoroughbred. Like his dam, he is very quiet; but he resents being interfered with, and he has never shown any of the curiosity or given evidence of the vigour so characteristic of his hybrid half-brother—he, in fact, behaves as if indifference and listlessness best became him. Moreover, while the hybrid easily withstands great cold and thrives on meagre fare, the pure-bred foal is affected by every decided change of temperature, and can only be maintained in decent condition if provided with highly nutritious food. In his ears, eyelashes, nostrils, and the form of the head he closely agrees with his dam, and his neigh is that of a horse. Had a mare with a like pedigree to Valda's, after producing a quagga hybrid, been put to Sir Gore Ouseley's black Arabian, the result would in all probability have been a foal quite devoid of permanent stripes.

(b) *Results of Experiments with Black Mares.*

Lord Morton having used a black Arabian stallion, I thought it advisable to experiment with a number of black mares. Of six nearly black mares experimented with, only two produced hybrids — viz., Mulatto, a 13-hands West Highland pony, generously lent by Lord Arthur Cecil; and Nora, an 11-hands Shetland pony. Mulatto (fig. 68) had the distinction of giving birth to the first hybrid bred between a Burchell zebra and an ordinary mare. This hybrid (Romulus, Mulatto's first foal) was born on the 12th August 1896. Very beautifully and brilliantly decorated as a foal, Romulus eventually became less striking, not owing to the stripes fading, but because the body colour in great part changed from a warm yellow-dun to a rich brown tint. In make he was stouter than Valda's hybrids, and from his birth up to his visit to the show of the Royal Agricultural Society at York (from which Romulus was carried off to Sand-

Fig. 68.—*Mulatto, Lord Arthur Cecil's West Highland pony and her hybrid foal Romulus, at. seven days.*

For Romulus as a four-year-old see fig. 78, p. 225.

ringham) he was noted for his keenness and vigour,[1] and for the intelligent interest he took in his surroundings. The arrangement of the stripes and general conformation of Romulus[2] are sufficiently indicated in figs. 46,[3] 48,[3] 68, and 78. On the 20th of August Mulatto was put to the grey Arab Benazrek,[4] and on the 16th July 1897 her second foal was born—a few days before it was due.

Many who watched the progress of the experiments up to the birth of Mulatto's second foal were quite prepared to hear that it in various ways forcibly suggested Mulatto's first mate, the zebra Matopo. Had the second foal been even a colourless imitation of Romulus, it would have gone far towards establishing the

Fig. 69.—*Mulatto's foal by the grey Arab Benazrek.*

fact of telegony—*i.e.*, of the existence of a potent and incomprehensible, though perhaps uncertain, factor, the secret of which might never be revealed. It was perhaps for this reason that the arrival of this foal was awaited by men of science as well as

[1] When several hybrids were on a visit to the Zoological Gardens, Dublin, in 1900, an Irishman, after studying their points, came to the conclusion that "Romulus was a boy."

[2] A full account of Romulus will be found in 'The Penicuik Experiments.' A. & C. Black. 1899.

[3] Transactions for 1901, pp. 125, 127.

[4] Benazrek, fig. 55 (bred by the late Earl of Warwick out of a grey Arab—Shemptes—by Mr Wilfrid Blunt's Azrek), is regarded as a credit to his distinguished ancestors.

breeders with an unusual amount of interest. Examined immediately after birth, Mulatto's second foal seemed in no way to differ from ordinary foals; but after a time, when seen in a subdued light, it presented numerous indistinct markings—most of them so subtle that it was impossible to say whether they were due to pigment or simply to the peculiar disposition of the hair. Unfortunately the control experiments proved a failure —*i.e.*, an Island pony resembling Mulatto previously put to Benazrek missed having a foal, while a black 14-hands Irish pony "picked" her foal (also by Benazrek) at the sixth month. Aware that colts are often indistinctly striped at birth, it was under the circumstances impossible to say whether or not I had obtained in Mulatto's faintly striped dark bay foal (fig. 69) evidence that (as Romanes, Millais, and many others believed) "infection" *occasionally* occurred. At first I almost persuaded myself that Mulatto had been influenced by her first mate; but though for a time tempted to draw conclusions from imperfect data, I eventually realised, as the markings one by one disappeared with the foal's coat, that I must wait for at least another year before deciding whether or not Mulatto afforded reliable evidence of infection. There was, however, a double disappointment in store; for, in the first place, Mulatto's faintly marked foal by Benazrek died when only five months old; and in the next place, Mulatto missed having a foal in 1898. On the 6th May 1899, however, she had a third foal at Knole, her old home in Kent, to Loch Corrie, a dark brown horse of her own strain belonging to Lord Arthur Cecil. Again there were faint markings; but fortunately, with the help of two control foals born about the same time, there was no longer any difficulty in deciding to what extent Mulatto's subsequent foals supported the telegony hypothesis. The two control foals were not only by the same sire as Mulatto's 1899 foal (fig. 70), they were out of dark West Highland mares closely related to Mulatto—mares which had never so much as seen a zebra. The foal out of the darker of the two mares presented as many markings as Mulatto's second and third foals, while the foal of the lighter coloured mare was so distinctly banded that the markings looked in one of a series of photographs as if they would persist as permanent stripes.

The markings in all three colts were, however, lost with the foal's coat. The presence of markings on the control foals robs the temporary markings (they can hardly be called stripes) on Mulatto's subsequent foals of all the value they might otherwise have had as evidence in support of infection. Moreover, as the hair of Mulatto's 1897 and 1899 foals in no way suggested the previous sire, and as there were no indications of striping in the skin or of zebra-like traits in the internal organs of the

Benazrek foal, it may be safely asserted that there is no evidence whatever of Mulatto having been in any way either temporarily or permanently influenced by Matopo, her first mate.

Nora (fig. 71), the black Shetland pony, had a foal when barely three years old to Wallace, a black prize Shetland stallion. This foal, of a dun tint, richly and distinctly banded at birth, eventually assumed a bay colour; but, unlike the West Highland

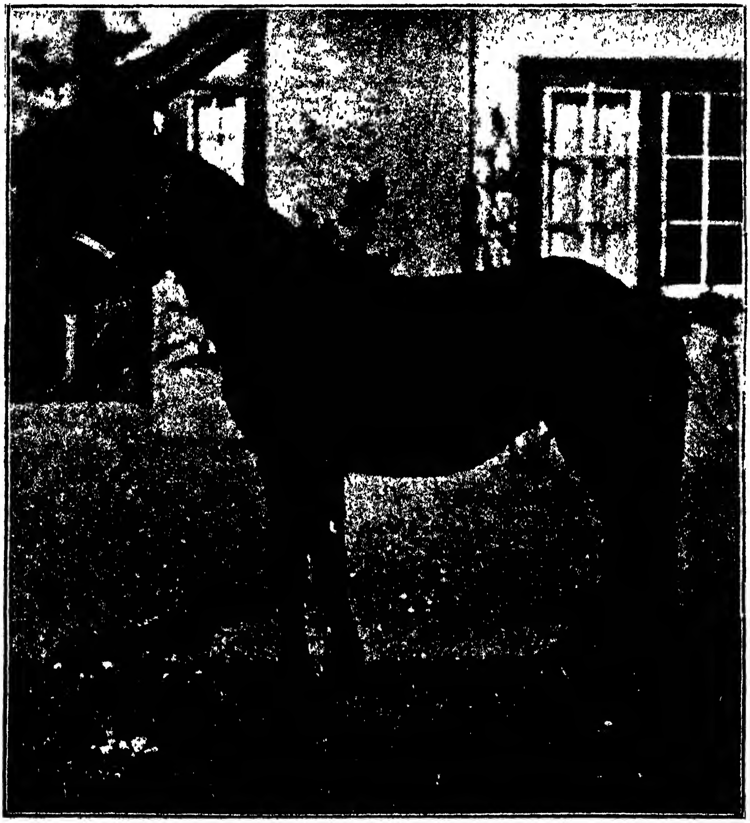

Fig. 70.—*Mulatto's foal by the West Highland pony Loch Corrie.*

foals mentioned above, three of the markings persisted as distinct stripes across the withers. In June 1897 Nora gave birth to a zebra hybrid. This hybrid (Norette, fig. 59) being in make, and especially in disposition, extremely like one of my zebra mares, and being, further, very profusely (though owing to the darkness of the ground-colour not strikingly) striped, especially over the croup, led me to conclude Nora was wanting in impressive-

ness, and hence likely to be easily saturated with the "nature and blood" of the zebra Matopo. In 1898 Nora had a foal to Cyclops, a small bay Welsh pony with a faint indication of stripes across his withers. This foal, Skua, though of a bay colour like Nora's first-born, was at birth quite destitute of stripes, and up till now has given no indication whatever, either in make, colour, or temperament, that her dam had been tainted by her striped mate the zebra. Seeing that Nora's first foal was permanently striped, it is somewhat remarkable, if there is such a thing as infection, that her foal by the bay Welsh pony (coming as it did immediately after the very zebra-like hybrid Norette) has from the first been absolutely devoid of stripes.[1]

Fig. 71.—*Nora, the dam of Norette* (fig. 59) *and two other hybrids.*

In 1899 Nora gave birth to a second, and in 1900 to a third, hybrid. The second and third hybrids, alike in make, markings, and disposition, are far less suggestive of zebras than Norette.[2] In 1901 she had a foal by a bay Arab horse, and about the same time Mousa, a black Shetland pony, almost the image of Nora, had a foal to the same bay Arab. Nora's foal promises to be in make and colour as like her Arab sire as Skua resembles her Welsh sire, while her half-sister (Mousa's foal) is her mother's daughter pure and simple. Evidently in Nora we have a mare

[1] This seems to indicate that Nora's first foal inherited his stripes through his sire Wallace.

[2] Nora hence lends no support to the belief in "saturation" so vigorously put forward by Bruce Lowe ('Breeding by the Figure System'). Horace Cox, London.

which counts for little in her offspring, and is hence presumably liable to be permanently impressed by her mates. But notwithstanding her want of prepotency, and the fact that she produced three vigorous hybrids to a highly prepotent zebra, there is no indication whatever that she has either in mind or body been in any way modified by being mated with a zebra.

(c) *Results of Experiments with Bay Mares.*

Twenty-one bay mares were experimented with, but though fourteen were successfully mated with Matopo, only six proved fertile.

Laura, a bay 14-hands half-Arab mare, was put to the zebra Matopo on the 7th April 1897; but, as so frequently happens, she broke service at the end of the sixth week.[1] She was again put to Matopo on the 26th July. Failing to settle, she was put to Lockstitch on the 16th August, and gave birth to a foal on the 4th July 1898. Laura being a cross between a bay Arab stallion and a grey half-bred pony, ought to have been easily impressed by the zebra; and as telegony (if there is such a thing) must of necessity be due to "infection" of the female germ-cells, she had a unique chance of proving that it at least occasionally happens. Laura's foal, as might perhaps have been expected, was at birth of a peculiar dun colour,—a sort of light leather-dun,—but there were no stripes. In make, and in its response to various kinds of stimuli, in call and in action, this foal in no way suggested either young zebras or young zebra hybrids. As the foal's coat was shed the colt became more and more like his sire, and now that he is over three years old, he in make resembles his dam, but in colour and temperament takes after his sire. In 1899 Laura had again a foal to Lockstitch. A month after the birth of this foal—*i.e.*, on the 4th August—she was put to a bay Arab (Syrian), and gave birth to her third foal on the 29th June 1900. Neither the 1899 nor the 1900 foal in any way—in mane, tail, hoofs, or chestnuts—resembles a zebra.

On the 25th May 1897 a 14·3-hands well-bred Irish pony (Rona) was put to Matopo. This mare—a bay with black points—when barely three years old gave birth to a hybrid foal on the 21st May 1898. Rona while carrying her hybrid foal suffered severely from the ravages of the parasite *Strongylus tetracanthus*. Perhaps partly on this account her hybrid, delicate from the first, died during a spell of cold damp weather when only ten weeks old. Hitherto I had used pure-bred stallions. Thinking the previous mate (Matopo) would have

[1] See 'A Critical Period in the Development of the Horse.' By J. C. Ewart. A. & C. Black. 1897.

a better chance of asserting himself in the subsequent offspring if the subsequent sire was a cross-bred animal, I put Rona to Mars Royal, the offspring of a hackney mare and Mars, a cross between a Norfolk trotter and a grey pony mare from Barra in the Outer Hebrides. Put to Mars Royal (a three-

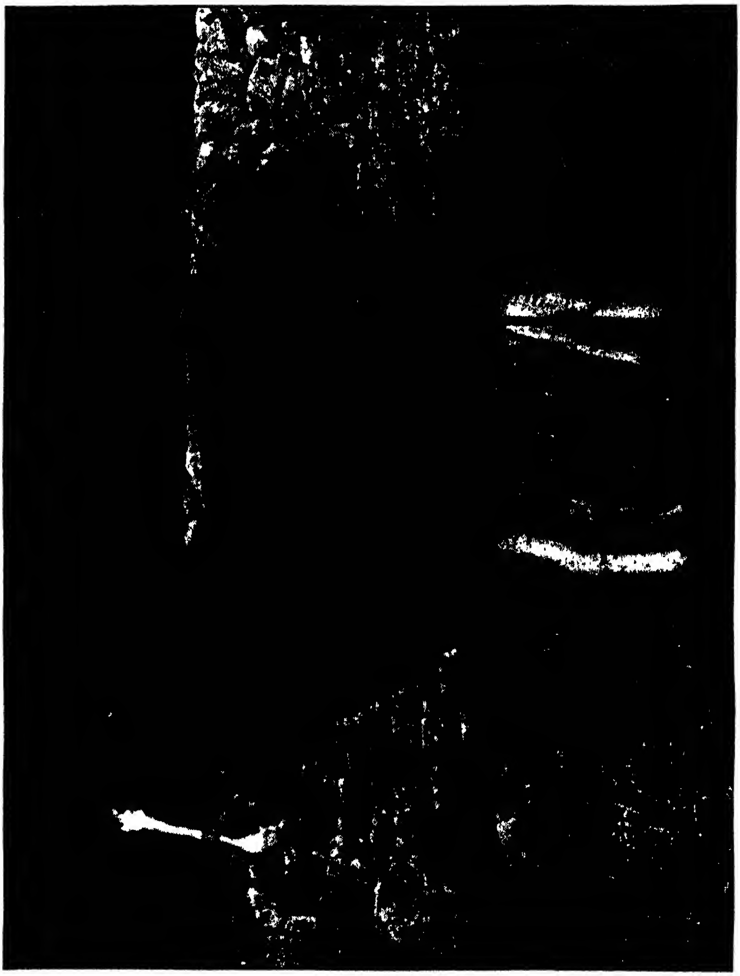

Fig. 72.—*Lady Douglas and her hybrid Brenda.*

year-old 13·2-hands bay pony with a star, white below fetlock of right fore- and left hind-foot, and with black mane and tail) on the 29th May 1898, Rona had a foal on the 13th May 1899, which has grown into a vigorous, shapely, 14-hands bay colt as nearly as possible intermediate between his parents, but in no

single point even remotely suggesting Matopo, with which his dam was mated when only two years old. With the exception of a few white hairs in the centre of the forehead, and a narrow white ring above the hind-hoofs, this colt is, like his dam, a typical bay with black points.

Of the twelve other bay mares (some of them of uncertain age) put to Matopo, only four proved fertile, and of these four only two need be mentioned—viz., Lady Douglas, a young 15-hands cart mare, and Biddy, a 14-hands three-parts-bred Irish pony. Lady Douglas, put to Matopo on the 29th June 1896, gave birth to a hybrid on the 18th June 1897. This hybrid (Brenda, fig. 72), in make and disposition quite unlike all the other hybrids, is of a bay colour and not very distinctly striped. During a considerable part of the year Brenda's mane hangs to one side, the hair of the upper part of the tail is relatively long, and there are short tufts at the fetlocks: moreover, the front chestnuts reach a considerable thickness before dropping off, and there is a small chestnut on the right hind-leg. As a foal Brenda was less intelligent than her hybrid half-brothers and sisters. Sometimes she wandered away from, and failed to recognise and respond to the return call of, her dam, or to at once identify her dam when recovered. Lady Douglas having been again put to Matopo (on the 18th July 1897), gave birth to a second hybrid on the 23rd June 1898. The second hybrid (Black Agnes) has from the first been higher at the withers (she now measures 14 hands) and finer in the "bone" than her sister, but she especially differs in being almost black—so black that the stripes, though abundant, are hardly visible at a distance of a few yards. Matopo has never succeeded in transmitting his light ground-colour to his hybrid offspring, but in Black Agnes his inability to hand on this highly specialised character is especially noticeable. Though the history of Lady Douglas is only imperfectly known, there are good reasons for believing Black Agnes has inherited her colour from a recent maternal ancestor. In temperament about an equal blend of a horse and a zebra, Black Agnes differs from Brenda in having been from the first extremely active and well able to take care of herself. During July and August of 1898 Lady Douglas was repeatedly put to Matopo, but she missed having a foal in 1899. Put to Mars Royal on the 29th April 1899, she had a foal on the 18th April 1900. This foal, a colt (fig. 73), promises when somewhat older to very closely resemble his dam. On the 13th May 1900 Lady Douglas was put to the bay Arab Syrian, and exactly a year afterwards her fourth foal arrived. In these two foals, as in the subsequent foal of Rona and the half-Arab, no one has been able after the closest scrutiny to detect even the minutest traces of the previous zebra

mate, doubtless because in the mares, as in the stallions with which they were subsequently bred, there was little or no tendency to revert to their somewhat remote striped ancestors.

The last of the bays to be mentioned is the 14-hands three-parts-bred Irish pony. This mare (Biddy), in my possession since 1893, was put to Matopo on the 6th of June 1896. Her foal (Remus, fig. 74) arrived on the 18th of May 1897. In Remus, now rising five, the ground-colour is light bay, the stripes—numerous, and distinct except over the croup, which has a mottled appearance—are of a dark bay or brown tint.

Fig. 73.—*Lady Douglas' foal by Mars Royal.*

Though in make somewhat like his dam, in temperament he is suggestive of his sire. In his hoofs, mane, and tail, and in the body hair, Remus is of all the hybrids most like a zebra.

On the 27th of May 1897 Biddy was put to Tupgill,—a bay thoroughbred stallion,—and on the 6th May 1898 she gave birth to her second foal. Biddy is a somewhat long-bodied mare on short well-formed legs. Her foal (Kathleen) by Tupgill has developed into a 14·3-hands mare, as long in the body as her dam, but with longer and, if anything, better legs; like her

dam, she is a bay with black points and black mane and tail. Kathleen in no way suggests either a zebra or a zebra hybrid. In 1898, and again in 1899, Biddy was put to Gold, a dark chestnut hackney horse, with the result that she produced two bay fillies which, though unlike Kathleen in make, agree with her in giving no hint whatever of Biddy's first mate.

Breeders in England have hitherto succeeded so well by the rule-of-thumb method that they, with a few notable exceptions, are as ignorant of, as they are indifferent about, scientific methods. It is doubtless for this reason that some of them even now fail to distinguish between reversion to a former mate and reversion to a more or less remote ancestor; while others, when forced to admit that the subsequent offspring in no way resemble a previous mate, forthwith assert that a "throw-back" takes place when the offspring of the subsequent offspring are bred from. Though to test one by one the assertions of breeders—who too often only wish to be left in the full enjoyment of beliefs but little in sympathy with the spirit of the age—would be highly unprofit-

Fig. 74.—*Biddy and her hybrid foal Remus when four days old.*

able, I thought it worth while to make a few experiments with some of the subsequent foals. Accordingly I had Kathleen—the half-sister of the hybrid Remus—put to Mars on the 13th August 1900—*i.e.*, when she was a little over two years old. On the 20th July Kathleen produced a bay foal, which, in being

quite destitute of stripes or markings of any kind, and in decidedly differing in make and in its behaviour from hybrids, fails to lend any support to the assumption that should the subsequent foals escape infection their offspring are liable to suffer.

Two bay mares were used for control experiments; but in the absence of zebra-like characters in the subsequent foals, there is no need to refer to their offspring.

(d) *Results of Experiments with Skewbald Mares.*

Of five yellow-and-white (skewbald) and grey-and-white (blaebald) Iceland mares only two proved fertile with Matopo, and only one has so far produced subsequent offspring to a pony sire. This mare, Tundra, as a three-year-old had, soon after her arrival from Iceland, a dun-coloured foal, sire unknown. On the 22nd of May 1897,—338 days after she was mated with Matopo,—when six years old, she gave birth to her second foal, the hybrid Hecla. This hybrid at birth had a rough coat, of a rufous-grey colour, a thick mane arching to both sides, but only faint markings. Had there been chestnuts on the hind-legs it would have resembled some of the Prevalsky foals recently imported from Central Asia. As the foal's coat was shed it became evident that Hecla would eventually be of a dark shade of dun, and indistinctly striped. In make as in colour this hybrid was very different both from her skewbald Iceland dam and her conspicuously striped zebra sire,—at a distance she looked not unlike a well-bred pony. She also differed from her immediate parents in her habits—*e.g.*, she sought cover during bright sunshine, and during rain-storms she humped up her back and gathered her feet together, as is the custom with uplands ponies. On July 24, Tundra was put to an 11-hands bay Shetland pony, and

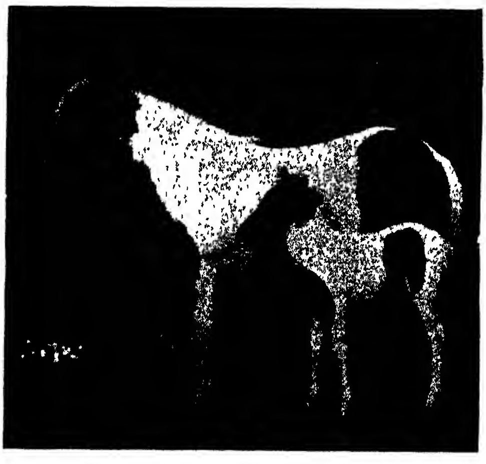

Fig. 75.—*Tundra and her foal Circus Girl.*

From 'Bibby's Quarterly.'

on the 15th June 1898 her third foal (Circus Girl, fig. 75) was born. When looking over the stock with the President of the Royal Society on the 16th June, Tundra's new foal seen at a distance looked more like a yellow-and-white calf than anything else. Tundra having produced first a dun foal and then a dark pony-like hybrid, I did not anticipate she would next give birth to a foal almost the image of herself. Circus Girl resembles her dam in make, temperament, and especially in action (they are both pacers), as well as in colour, but she is about as unlike a zebra as a pony well could be.

Having decided to give Tundra a further chance of becoming infected, she was put to Matopo on the 24th June 1898, and had a second hybrid on the 4th June 1899. This hybrid (Sir John, fig. 76) is, except over the croup, richly striped, and owing to the ground-colour being only a few shades darker than in his sire Matopo, the markings are very distinct. In some Iceland ponies the hair is of the same tint as the ground-colour of Sir John, and as this hybrid is in make and disposition more a pony than a zebra, it may be assumed he reproduces fairly accurately a not very remote wild ancestor. On June 12, Tundra was again put to Matopo, but, upset perhaps by her visit to the Highland and Agricultural Show, she failed to settle until the last week of August. During the first week of August Tundra was put to Matopo on the 1st, 3rd, and 5th, and to the bay Arab Syrian on the 4th, 5th, and 7th. On the 23rd August she was again put to Syrian, and on the 25th and 27th to Matopo. Having at last settled, there was considerable scope for speculating as to whether her 1900 foal would be a hybrid, another Circus Girl, or partly skewbald and partly zebra. When on the 17th July her fifth foal arrived, it was at once evident that the zebra had in no way controlled the development; for, like Circus Girl, it very accurately reproduced the markings of the dam. In other respects it was nearly intermediate between the dam and the Arab sire.

It will, I think, be admitted that Tundra had abundant opportunities of being infected both directly and indirectly by the zebra Matopo. Of infection I fail to find any evidence; but in this I seem to differ from a writer in a recent number of the 'British Medical Journal,' who, referring to Tundra's prepotency, says, "It may not be unreasonable to connect it with her mating with the zebra." [1] This writer assumes that Tundra had two hybrid foals before she gave birth to Circus Girl. He says, after producing a distinctly banded hybrid (Sir John), "She then produced the skewbald foal to the bay Shetland." As a matter of fact, Circus Girl (as I stated in a paper read at the Dublin meeting of the National Veterinary Association in

[1] Brit. Med. Journ., 14th September 1901, p. 723.

The hybrid Sir John. Fig. 76. Tundra. Circus Girl.

August 1900) is a year older than Sir John. How the zebra could increase the prepotency of Tundra I am unable to imagine.

In my address to the Zoological Section of the British Association last September I gave reasons for the belief that the prepotency varies with the age and fitness of the parents, and the ripeness of the germ-cells. If Tundra's first mate (the unknown Iceland pony) was more mature and in better condition, as is extremely probable, or if he was more inbred, which is quite possible, the foal would, other things being equal, resemble the sire. How Matopo could so influence Tundra that after producing a hybrid she gave birth to a foal which was skewbald like herself instead of bay like the sire is quite incomprehensible—for, as already mentioned, bearing mules is more likely to destroy than increase the prepotency.

In addition to the chestnut, black, bay, and skewbald mares mentioned, seventeen others, including yellow-dun, spotted, and grey, were experimented with; but only two of these proved fertile with the zebra.[1] The results of these additional experiments, without adding any new light, increase the already strong evidence adduced, that when experiments are carefully conducted and controlled, and when due allowance is made for ordinary variation, more especially retrogressive variation, there is a complete absence of evidence that a mare of one species is liable to be infected when mated either with a tame or a wild member of a different species.

(e) *Results of Baron de Parana's Experiments.*

For some years Baron de Parana has been breeding zebra hybrids in Brazil. The first of the Brazil hybrids (Lordello) arrived on the 5th December 1896, a few months after the birth of Romulus. Baron de Parana has been good enough to send me an account of Lordello and six other zebra ♂-horse ♀ hybrids (zebrules), and also a number of photographs, one of which shows a zebra mare with a hybrid (fig. 77) by a half-bred English stallion. I used in my experiments Chapman's variety of the Burchell zebra, but in Brazil the true Burchell zebra (*E. burchelli typicus*) was made use of—a white-legged variety with distinct shadow stripes, in build not far removed from the extinct quagga. The characters of this variety are well illustrated by the mare, Isabelle (fig. 77), the dam of Baron de Parana's zebrinny, Sphinx. All the Brazil hybrids out of

[1] That only about half the mares experimented with were successfully mated with the zebra is partly due to the fact that several Iceland mares, though only two years old, proved to be in foal on arrival, and partly because Matopo, being quite untamed, was unapproachable when a mare was in his vicinity. Moreover, he took no notice, as is the custom with zebras, of restive mares.

ordinary mares very closely resemble Romulus in their markings—the legs being well striped notwithstanding the absence of markings on the legs of their sire—but they have rounder quarters and are apparently more cob-like in build.

One of the Brazil mares, Ella, after giving birth to two hybrids had a foal to a four-sixteenths Arab horse. This foal, Baron de Parana says, has "nothing which could recall the

Fig. 77.—*Baron de Parana's true Burchell zebra mare Isabelle and her hybrid Sphinx.*

zebra."[1] Another mare, Denise (a 15·3-hands brown mare), after having a hybrid (Salomon) not unlike Brenda (fig. 72) in make, had a foal to an ordinary horse. This pure bred foal neither recalls the previous zebra mate, nor in any way resembles its half-brother the hybrid Salomon.

The Brazil results, like my own, afford no support to the doctrine of infection.

[1] The Field, 1st December 1900.

3. *Results of Experiments with Members of Different Breeds of Horses.*

While certain physiologists agree with Mr Herbert Spencer that evidence of infection is not likely to be obtained unless the first sire belongs to a different species, or to at least a markedly different stock, from the dam, many breeders, assuming a violent outcross makes infection all but impossible, believe that it is most likely to occur (that it, indeed, frequently does occur) when the first mate at most belongs to a different breed or strain from the dam. For example, it has often been alleged that when a Shire or Clydesdale mare is served by a thoroughbred one year, and by a horse of her own breed the next, the subsequent foal frequently presents many points of the thoroughbred—*i.e.*, of the previous mate. Likewise the offspring of thoroughbred mares are said to throw back to previous Shire and Clydesdale mates—*e.g.*, Mulatto, a thoroughbred stallion, was said to owe his large hoofs to his dam having been previously mated with a cart-horse.[1] Again, in some parts of India when a mare has been branded to be served by, say, an Arab horse, however unsatisfactory her produce, she must continue breeding to Arabs, because it is assumed she has been so infected that, however mated subsequently, she would continue to throw inferior Arab-like stock.

I have not made experiments with Clydesdales or Shires, but I have seen a number of thoroughbred colts out of mares that had previously bred with a cart-horse, and Clydesdale colts out of mares that had bred with a thoroughbred. Though (except when one of the parents was highly prepotent) the foals often varied, they afforded no evidence of infection. Some years ago Dr Bell of Dunfermline made a number of experiments with horses.[2] In 1885 he put a three-parts-bred but non-impressive mare to Picaninny, next year to Hamilton, the following year to Heatherbrae (all thoroughbreds); the fourth year she was put to Planet, an American hackney. Dr Bell failed to find any evidence of infection in any of the subsequent foals.

In 1897 I put a half-bred bay mare to a bay thoroughbred. After giving birth to a foal of her own colour, she was put to a chestnut hackney, first in 1899 and next in 1900. Of her two foals by the hackney, one slightly resembles the sire, the other looks like a small cart-horse: neither in any way suggests the previous thoroughbred mate. In colour they are of the same shade of bay as their dam.

A second half-bred bay mare, after having first a nearly whole-

[1] In this case the large hoofs were inherited from the thoroughbred sire Highclere.

[2] Bell, Journ. of Anat. and Physiol., vol. xxx.

coloured chestnut and next a whole-coloured bay foal to a chestnut thoroughbred, had to a bay Arab a light chestnut foal with a very conspicuous white face and white hind-shanks—a foal not only quite unlike the previous chestnut mate, but different from all the known ancestors.

Another mare of a dark-grey colour had first an iron-grey foal (by Benazrek) with a blaze which extended over nearly the whole face. This mare had next a whole-coloured bay foal by a chestnut thoroughbred. Had this grey mare's foal had a white face like the one which unexpectedly appeared on the foal referred to above, some would doubtless have regarded it as an instance of infection.

Two other mares—one bay, the other light grey—after having a white-faced foal to Benazrek, had each a foal to a bay stallion. These foals—dark bays—in no way suggested Benazrek, the bald-faced previous sire.

As it happens, Baron de Parana has also made experiments with different breeds of horses. Writing about a year ago, he says: "I have a mare which had two foals by a horse, a native of this country [Brazil]; afterwards she had two foals to a Percheron horse, and thereafter three by an Arab horse from Constantinople. All these foals showed the characters of their respective sires. Those by the Percheron horse do not resemble in anything the offspring of the native stallion, and those by the Arab resemble in nothing their elder brothers." That the subsequent offspring resembled either the Percheron or the Arab implies that the mare was non-prepotent, and was hence all the more liable to receive permanent impressions from the previous mates.

4. *Results of Experiments between Members of the same Breed.*

Two instances of supposed infection of this kind given by M'Gillivray are often quoted. In the one case, several foals in the royal stud at Hampton Court got by Actæon were said to present unequivocal marks of the horse Colonel.[1] The dams of these foals had been put to Colonel the previous year—*i.e.*, Colonel was the previous mate. In the other, a colt got by Laurel so resembled another horse, Camel, that it was asserted at Newmarket that he must have been got by Camel; but Camel, instead of being the actual sire, was only, like Colonel, the previous mate.[2] A more recent instance is that of Greyfriar, got by Hermit out of Perseverance. It was said Greyfriar was grey because his dam had previously had a foal to a grey horse. As, however, Perseverance was grey, this explanation

[1] Colonel took part in the Derby in 1828.
[2] Veterinary Manual. By J. M'Gillivray, M.R.C.V.S., Aberdeen, 1861.

was wholly unnecessary.[1] Better instances are associated with Blair Athol. It is said that mares put to Blair Athol (a bald-faced chestnut) one year, gave birth subsequently to Blair Athol-like foals when mated with quite different sires, such as Wild Oats.

By way of indicating that the infection doctrine is called in to account for minute difference between offspring and parents, the following case may be mentioned. A brown hackney mare with black points, quite free from white, was put to a brown hackney three years running, and produced first a brown colt with white markings on heels and face exactly like the sire, and then two rather light but whole-coloured chestnut colts.

The mare was next put to a son of the above stallion (a horse of a dark chestnut colour but with white hind-heels), and produced a dark bay filly with black points and quite free from white. The fifth foal of this mare, though by the brown sire of the first three foals, exactly resembled her fourth foal in colour, but was deficient in quality. The owner of this mare, who, it may be mentioned, has had the advantage of a scientific training, believes her fifth foal resembled her fourth because she had been infected by the chestnut stallion. Obviously there is another possible explanation. One naturally accounts for the fourth foal being brown like the dam by saying she was more impressive, more prepotent, than her chestnut mate. But if, as I have already pointed out, prepotency is a varying factor,—that it varies with the age, condition, &c.,—in order to account for the fifth foal being also like the dam, it is only necessary to assume that the mare when again put to her previous mate the brown hackney stallion was, at least for the time being, sufficiently prepotent to control the development.[2] In such a case the law of parsimony forbids the use of a far-fetched explanation, such as telegony affords, when a quite simple one, such as I have suggested, is at hand. Hence the owner of this mare was hardly justified in believing the fifth colt was the combined result of the brown and the chestnut sires.

A very careful consideration of the whole subject has led me to the conclusion that no trustworthy evidence in support of telegony can be obtained by experiments with members of the same breed of horses. My chief reason for coming to this conclusion is that in experiments with closely related animals — even when their pedigrees are known—it is impossible to prove that differences between the offspring and their immediate parents, differences, it may be, highly suggestive of a previous mate, are not due to reversion to a previous ancestor or to new departures

[1] Bell, Journ. of Anat. and Physiol., vol. xxx. p. 259.

[2] Had the fifth foal been a dark chestnut like the second mate, there would have been more excuse for assuming infection.

which by a mere coincidence recall a previous mate. It has been again and again pointed out that the modern thoroughbreds have mainly descended from a few imported sires—more especially from Byerly Turk (imported in 1689), the Darley Arabian (imported in 1710), and the Godolphin Arabian (imported in 1740)—and from a limited number of "Royal" and native mares. The founders of the breed having been few in number, it might *a priori* have been assumed that thoroughbred horses would now as closely resemble each other as the members of a herd of wild cattle, of a troop of kiang (the wild ass—*E. hemionus*—of Tibet), or of a troop of the true wild horse (*E. przewalskii*) of Central Asia. That this is not the case—that there is, in fact, a striking absence of uniformity amongst thoroughbreds—is notorious. This, however, is not surprising when it is remembered that after three centuries of freedom (*i.e.*, of natural selection) the so-called wild horses of the American prairies—descendants of horses introduced by the Spaniards during the middle ages—varied enormously even in the same area. Catlin, *e.g.*, tells us the wild descendants of the Spanish horses of Mexico were "of all colours—black, grey, roan, and roan pied with sorrel." If variation proceeded unchecked amongst the feral horses of the Far West, it is not surprising that it goes on still amongst thoroughbreds, seeing that the chief aim of breeders of race-horses has been to gain speed and courage—not the uniformity in make and colour so generally sought for by breeders of sheep and cattle. If, as is admitted, racehorses differ in make, colour, and disposition—if, *e.g.*, the Derby winner of one year is in conformation surprisingly unlike the Derby winner of the next, and if mares of, say, the round-quartered Bend Or type are put to square-quartered horses such as Ladas or Galtee More, and if, moreover, the characters of the offspring depend to a certain extent on the age, condition, and blood-relationship of the parents, they (the offspring) are bound to differ from their immediate ancestors even when own brothers and sisters.

In some of these differences breeders have often found evidence of infection; but, as I have already said, such evidence is far from convincing—is, in fact, worthless. Take, *e.g.*, the foals by Wild Oats, which because of their white face breeders declared their dams had been infected by Blair Athol. Naturalists and breeders alike have hitherto been far too ready to make use of the reversion hypothesis, to assume that it is much easier to "throw back" to an ancestor than to produce something new. When a foal with an unsightly white face appears, or with a white head and white "stockings," the question is at once asked, Where has the colt got his gaudy colours? Whence, it may be asked, came the white head of the modern Hereford cattle? Certainly not from throwing back either to an ancestor

or a previous mate, for not very long ago Hereford cattle were as whole-coloured as Red Devons and Black Galloways. It is surprising how little we know about the physiology of colour—why, *e.g.*, the supply of pigment seems suddenly to give out, with the result that the head, the end of the tail, and the distal part of the limbs remain absolutely white.

Recent experiments seem to indicate that there is an intimate relation between the colour of the offspring and the vigour of the parents, and especially that the vigour is impaired by in-breeding, by debilitating diseases, by change of habitat, by exchanging the milk for the permanent teeth, and during the growth of a new coat.

Though when white comes it often comes to stay, it by no means follows that every foal inherits its bald face from a more or less remote ancestor. At Crabbit Park, Arab stud bay stallions (according to the records at my disposal) always get bay foals out of bay mares, and only at rare intervals does a chestnut stallion get a chestnut foal out of a bay mare. Nevertheless, two years ago one of my bay mares produced to a bay Arab with black points a light chestnut foal with nearly the whole of the front and sides of the face as white as snow. Had this mare previously bred with a bald-faced chestnut horse the peculiar colour of the foal might have been ascribed to the previous mate; but as the mare had a bay foal the previous year to a chestnut stallion, no such explanation was admissible. Further, as there was no reason for assuming the white face had been inherited, and as the same Arab stallion the following year got whole-coloured bay or black foals, I felt inclined to credit the bay Arab rather than the bay mare with the foal's white face—all the more so as in 1899 he ran the risk of becoming sterile from an attack of orchitis.

Undoubtedly strains characterised by a white head—*e.g.*, Hereford cattle—or a bald face—*e.g.*, Blair Athol thoroughbreds—were once whole-coloured—*i.e.*, at some particular stage in the history of the strain the whiteness made its appearance. It is a little late in the day to account for such a phenomenon by the doctrine of maternal impressions. Hence all that can be said in the meantime is that there must have been in one or more of the ancestors a sudden arrest in the deposit of pigment. But if this has happened in many different strains in the past, there is no reason why it should not happen unexpectedly and suddenly in the future.

Another instance of a decided difference in colour between parents and offspring may be cited. A roan-coloured Shetland mare, after producing a roan foal to a black sire and three bay colts—two by a black sire and one by a brown sire—had a very light dun colt to her six-year-old bay son. This foal, in

which the muzzle, legs, and under-surface of body were almost white, was even after losing the foal's coat of a decidedly mealy colour. The striking difference between the colt and his parents was probably partly due to close inbreeding, but chiefly, I believe, to his dam being extremely ill during the first eight of the eleven months she carried her foal—having strangles followed by chronic septic abscesses. Three years later, when again in good condition, this mare produced to a brown sire, a red roan colt so like herself that it was evident she had regained her, for a time greatly diminished, prepotency.[1]

Differences in the hoofs, tail, and mane, in the conformation and temperament, are frequently, like differences in the colour, due to new departures rather than to reversions, and in no single instance out of the many cases investigated did I find any trustworthy evidence of infection.

5. *Result of an Experiment with two Species of Asses.*[2]

The African and Asiatic wild asses form two perfectly distinct groups. The African section includes the Abyssinian ass (*E. tæniopus*) and the Somali ass (*E. somalicus*), the Asiatic the kiang (*E. hemionus*) and its near allies, the onager (*E. onager*) and the Syrian ass (*E. hemippus*). The Abyssinian wild ass is of a grey colour, has a shoulder stripe, a dorsal band, and long ears. The Somali ass is also grey, but distinct stripes only occur on the legs. The Syrian wild ass (like the kiang and onager) is of a reddish (rufous) colour, has a wide dorsal band but no shoulder stripe, and ears somewhat shorter than the Abyssinian ass.

In 1883 an Abyssinian wild she-ass (in the Zoological Gardens, London) when three years old had a foal to a Syrian ass. This hybrid foal resembled the Syrian sire, which implies that the Abyssinian dam was at the time of conception less impressive than the Syrian sire—perhaps because she was younger or not absolutely clean bred.

In each of the years 1889, 1891, 1892, and 1898, the Abyssinian had a foal to an ass of her own species. The 1889 and 1891 foals resembled their parents, but the 1892 foal was of a reddish fawn colour, had a large star on the forehead and a white blaze down the face; moreover, the ears were somewhat shorter than in the parents. The 1898 foal, like the 1883 hybrid, was of a reddish colour. It has been assumed that the 1892 and 1898 foals differed from their immediate parents

[1] I am indebted to the very thoughtful observers the Ladies Hope, Great Hollenden Farm, Kent, for the information about this mare and her foals.

[2] An account of this experiment will be found in Tegetmeier and Sutherland's 'Horses, Asses, and Mules.' Horace Cox, London.

because their dam had been infected directly by her 1882 Syrian mate or indirectly by her 1883 hybrid. It will, however, be evident that in having a star and a blaze the 1892 foal not only very decidedly differed from the first mate (the Syrian ass) but also from the first foal (the Syrian-Abyssinian hybrid). A blaze is so rare in the ass group that it must be regarded as a sport—as an indication of a want of stability in at least one of the parents: it certainly cannot be regarded as due to infection.

There remains the rufous colour and smaller ears to be accounted for. There are excellent reasons for supposing that asses as well as horses have sprung from rufous or dun-coloured ancestors, and that the long ears of the African asses have been acquired (by selection) to adapt them for their peculiar environment. If the Abyssinian she-ass, either because she was cross-bred or for other reasons, was sufficiently unstable in 1892 to give birth to a foal with a star and a bald face, it is not surprising that she subsequently produced a foal presenting in its ears and coat-colour what may very well be regarded as ancestral characters. However the variations may be accounted for, it seems to me we are not justified in finding an explanation in the doctrine of infection.

Summary of Experiments with the Equidæ.

At the outset it was pointed out that for at least a couple of centuries it has been commonly believed that a mare is so profoundly impressed by her first mate that should she subsequently have foals to somewhat different mates these foals are likely in some of their characters to "throw back" to the first mate.[1] It has been assumed that the "infection" may be either direct or indirect: direct when the unused male germ-plasm "infects" the immature ova; indirect when protoplasmic masses from the developing foal enter the circulation of the mare and eventually reach and blend with the maturing ova. When direct, the infected foals should obviously resemble the previous mate; when indirect, they should, while suggesting the previous mate, more especially resemble the foal or foals got by the previous mate.

The evidence in support of the long-cherished belief that mares used for mule-breeding are infected was first considered. Mainly from recent information collected by Baron de Parana in Brazil, the conclusion was arrived at, that though thousands of mares have annually the chance of being "corrupted" at mule-

[1] It ought perhaps to have been mentioned that some believe each new mate produces more or less permanent impressions, and that it is by some assumed the subsequent offspring resemble not so much the previous mate as the previous offspring.

breeding establishments, there is no satisfactory evidence that a single mare has ever been infected by an ass—that infection even occasionally occurs, this being all that the more thoughtful believers in telegony now argue for.

The greater part of the paper deals with the results of experiments with horses and zebras. The Morton-Ouseley experiment is first considered at length. It is pointed out that both the colour and the stripes which characterised the subsequent foals can be accounted for without the help of the telegony doctrine, and especially that the statement as to the mane in the filly—hitherto often considered conclusive proof of infection—is not in keeping with the very careful drawing of Agassé. In support of this view it is pointed out that when the mane is short, stiff, and upright in the Equidæ, the upper part of the tail carries short deciduous hairs, as in zebras and zebra-hybrids. But in both the colt and filly the tail resembled that of their black Arabian sire. Robbed of the support of an upright mane in the filly, the evidence in support of the view that the chestnut mare was infected by the quagga is no longer of any real value.

The section devoted to experiments with the horse and the Burchell zebra contains first a short account of the chief external characters and of the habits and disposition of the zebra (Matopo) used throughout the investigation, and of his hybrid offspring. This is followed by a record of the progeny, mixed and pure, of a number of mares. The chief results of the experiments are summarised in the table on pp. 226-229.

When the facts set forth in this table are considered along with the results obtained by Baron de Parana in Brazil, there seems no escape from the conclusion that mares are not liable to be infected—*i.e.*, modified in make, colour, or disposition, or in the gestation period[1]—by sires belonging to a quite different species. It might be said that to most breeders in this country it is a matter of indifference whether or not mares are more or less permanently influenced by ass or zebra sires,—that the important question is, "Do mares of one breed throw back to a previous mate belonging to a different breed, or to a former mate of the same breed as themselves who happens to differ in make, colour, or temperament, hardiness, staying power, or quality?" The answer to this question is (1) that there is a complete absence of reliable evidence that a mare by having a foal to a horse of a different breed is as it were born again—is endowed with a new set of characters likely to be transmitted to her future offspring by horses of her own strain; and (2) that there is as little evidence that a mare can be so influenced by a member of her own breed (endowed with the special characteristics of, it may be, a closely-related mate), that for a time

[1] In zebras gestation period is about a month longer than in the domestic horse.

her offspring to a horse the image of herself (or distinguished by traits unlike those of her first mate) will in some subtle way suggest the previous mate. Though when my telegony experiments were started in 1895, I, with Weismann and many others, saw no reason why "infection" might not be a cause of variation,—though I hoped to prove the fact of telegony,—I am now firmly convinced that there never has been an undoubted instance of infection in either dogs, rabbits, or horses. It remains to be seen whether some of the other domestic animals—*e.g.*, cattle, sheep, or pigs—in any way lend support to the time-honoured and widespread belief.

Figs. 55 to 58, 60 to 62, 64, 65, and 69, from 'The Penicuik Experiments,' by J. C. Ewart. A. & C. Black, London. 1899.

Figs. 59, 67, 70, and 76, from the 'Guide to the Zebra Hybrids, &c.,' by J. C. Ewart. T. & A. Constable, Edinburgh. 1900.

Fig. 63, from a drawing by H. Goodchild.

(*To be completed in a future volume of the 'Transactions.'*)

Fig. 78.—*Romulus. Mulatto's hybrid when four years old.*

(From 'The Sphere.')

TABLE GIVING THE MORE IMPORTANT DETAILS OF THE ZEBRA AND HORSE EXPERIMENTS.

Name, colour, breed, and size of mare.	Date of service.	Sire.	Result	Date of birth.	Gestation period weeks	Gestation period days	Remarks.
VALDA, fig. 66, chestnut, T.B. with blaze, 14·2	May 1, 1897 June 25, 1897	Matopo, fig. 61 do.	Twin hybrids, ♂ & ♀	May 31, 1898	48	4	Only the colt (Nestor) survives. Resembles dam in colour, faintly striped.
	June 9, 1898 June 30, 1898	do. Lockstitch, chest., T.B.	Chest. colt, Hector, fig. 67	May 31, 1899	47	6	Has blaze; closely resembles dam in make, but brighter in colour; no resemblance to a zebra.
	June 9, 1899	Matopo	Hybrid colt, Birgus	May 12, 1900	48	1	Birgus, very richly and distinctly banded, is in make more a horse than a zebra; chestnuts on hind-legs.
	May 21, 1900 July 26, 1900	do. Diplomat, dark chest., T.B.	Chest. filly, Diploma	June 16, 1901	46	3	A very delicate, slender, listless foal, with large star and blaze; built like a racer; no suggestion of a zebra.
SOLWAY MAID, chestnut, T.B., 15·2	Aug. 5, 1897	Lockstitch	Chest. colt	July 1, 1898	47	1	A control experiment. Colt like Hector in make and colour, but taller.
MULATTO, fig. 68, black, W. Highland pony, 13·0	Sept. 5, 1895	Matopo	Hybrid colt, Romulus, figs. 68 and 78	Aug. 12, 1896	48	6	Romulus, dark in colour, is richly striped, and in make nearly intermediate between parents.
	Aug. 20, 1896	Benazrek, fig. 55, grey, Arab	Dark colt, fig. 69	July 16, 1897	47	1	This colt, faintly marked at birth, died when about five months old.
	June 1898	Loch Corrie, dark, W. Highland pony	Dark filly, fig. 70	May 6, 1899	?		Faintly marked at birth, especially over croup, markings lost with foal's coat.

Bonnie Jean, dark, W. Highland pony	June 1898	do.	Dark foal	April 30, 1899		?	A control experiment. Faintly marked like Mulatto's second and third foals.
Rum, dark, W. Highland pony	June 1898	do.	do.	May 3, 1899		?	Do. do. do.
Nora, fig. 71, black, Shetland, 11·0	July 1894	Wallace, black, Shetland	Bay colt	June 15, 1895		?	Dun colour and richly striped at birth; three permanent shoulder stripes.
	June 24, 1896	Matopo	Dark hybrid, Norette, fig. 59	June 7, 1897	50	6	In colour and stripes similar to Romulus; zebra-like in make and disposition.
	June 16, 1897	Cyclops, bay, Welsh pony	Bay filly, Skua	May 31, 1898	50	6	Skua very like sire in make and colour; never had any stripes.
	June 9, 1898	Matopo			...		...
	July 3, 1898	do.	Dark hybrid, Eyra	June 18, 1899	50	0	Stripes less distinct; less like a zebra than Norette
	July 22, 1899	do.	Dark hybrid, Nero	July 1, 1900	49	0	In make and markings very like Norette.
	July 23, 1899	Chest., Arab					
	July 11, 1900	Mars Royal, bay, hackney	..		.		...
	July 30, 1900	Syrian, bay, Arab	Brown filly	July 3, 1901	48	2	This filly closely resembles sire; no suggestion of a zebra; gestation period diminished since 1898.
Mousa, black, Shetland, 11·1	May 2, 1900	Mars Royal					
	May 22, 1900	Syrian	Black filly	April 22 1901	47	6	Control experiment. In make and colour very like her dam.
Laura, bay, half Arab, 14·0	April 7, 1897	Matopo	Broke service, May 23	..			..
	July 26, 1897	do.		..	.		.
	Aug. 16, 1897	Lock-stitch	Chest. colt	July 4, 1898	46	0	This colt, somewhat nervous like his sire, in no way suggests a zebra.
	Aug. 6, 1898	do.	Bay filly	July 4, 1899	47	3	This filly has the make of a high-class T.B.
	Aug. 4, 1899	Syrian, bay, Arab	Chest. filly	June 29, 1900	47	0	A very light chestnut, with great part of head white, and white hind-shanks

TABLE GIVING THE MORE IMPORTANT DETAILS OF THE ZEBRA AND HORSE EXPERIMENTS—*continued.*

Name, colour, breed, and size of mare	Date of service.	Sire	Result.	Date of birth	Gestation period weeks	Gestation period days	Remarks.
RONA, bay, T.B., 14·3	May 25, 1897	Matopo	Light bay hybrid	May 21, 1898	51	4	A delicate faintly-striped hybrid that died when about three months old.
	May 29, 1898	Mars Royal	Bay colt	May 13, 1899	49	6	Nearly intermediate between sire and dam: never in any way suggested a zebra.
LADY DOUGLAS, fig. 72, bay, cart mare, 15·0	June 29, 1896	Matopo	Hybrid filly, Brenda, fig. 72	June 18, 1897	50	4	Brenda, indistinctly striped, is more heavy in her build than any of the other hybrids
	July 18, 1897	do.	Hybrid filly, Black Agnes	June 23, 1898	48	4	A very dark tall hybrid: finer in the bone than her full-sister Brenda.
	July 12, 1898 Aug. 5, 1898 Aug 25, 1898 Sept 16, 1898	do.	.				...
	April 29, 1899	Mars Royal	Bay colt, fig. 73	April 18, 1900	50	4	This colt takes after his dam; he has a decidedly cross-bred look, but no suggestion of a zebra.
	May 13, 1900	Syrian	Brown colt	May 13, 1901	52	1	This colt takes after his Arab sire; he in no way resembles a zebra.
BIDDY, fig. 74, bay, 3-parts-bred Irish pony, 14·0	June 6, 1896	Matopo	Bay hybrid colt, Remus, fig. 74	May 18, 1897	49	3	A very characteristic and well-striped hybrid; especially zebra-like in hoofs, mane, and tail.
	May 27, 1897	Tupgill, chest., T.B.	Bay filly, Kathleen	May 6, 1898	49	1	In colour and make like her dam; never had any markings.
	June 6, 1898	Matopo	...				...
	June 29, 1898	Gold, chest., hackney	.				...
	July 18, 1898	do.	Bay filly	June 9, 1899	46	4	This filly, though bay like her dam, is built on the lines of a hackney.

	June 17, 1899	Matopo					...
	July 26, 1899	do.					
	July 27, 1899	Gold	Bay filly	June 21. 1900	47	0	This is a hollow-backed bay with black points; quite unlike both Matopo and Remus.
KATHLEEN, bay, by Tupgill out of Biddy, 14·3	Aug. 13, 1900	Mars, bay, Highland hackney cross	Bay colt	July 20. 1901	48	5	This colt, the offspring of a "subsequent" foal, in no way suggests his granddam's first mate.
TUNDRA, fig. 75, skewbald, Iceland, 12·	1892	Unknown	Leather-dun	1893			This foal was born shortly after Tundra arrived from Iceland.
	June 18, 1896	Matopo	Dark hybrid filly	May 22, 1897	48	2	Dark, indistinctly striped, and pony-like.
	May 31, 1897	Cyclops, bay, Welsh pony					...
	June 30, 1897	do.					...
	July 17, 1897	Basil, bay, Shetland					...
	July 24, 1897	Basil	Skewbald filly, Circus Girl, figs. 75 and 76	June 15 1898	46	4	Circus Girl is the image of her mother, and hence differs from both her sire and the previous mate, Matopo.
	June 24, 1898	Matopo	Dun hybrid, Sir John, fig. 76	June 4. 1899	49	2	Sir John, though built like a pony, is, except over the croup, very distinctly striped.
	June 12, 1899	do.					...
	Aug. 1, 3, 5, 1899	do.					...
	Aug 4, 5, 7, 1899	Syrian					...
	Aug. 23, 1899	do.	Skewbald filly	July 17, 1900	46	6	This filly, though by a bay Arab, is marked like her dam, but in make suggests an Arab. Like Circus Girl, she never in any way resembled a zebra.
	Aug. 25, 27, 1899	Matopo					..

INSECT ATTACKS IN 1901.

By Dr R. Stewart MacDougall, M.A., Consulting Entomologist to the Society.

During 1901, a year favourable for the development and spread of insect life, I have received numerous inquiries as to insects destructive to agricultural, forest, and fruit crops. A list of these I have previously reported to the Society, and, following my usual custom, I now give in the 'Transactions' a more detailed notice of some species, chosen either because of their grievous mischief or because of obscure points worth noting in their life-history.

The Pine Beetle (*Hylesinus* or *Hylurgus piniperda*).

During the year I have had many complaints about this pest, which is really a scourge in our Scottish pine-woods.

Beetle.—The adult beetle is a little over one-sixth of an inch in length. On first emerging from the tree it is reddish-brown, but soon darkens into a glossy black; the antennæ and the legs are reddish-brown. On examination with a lens the wing-covers show longitudinal, finely-punctured stripes. The spaces between these stripes have a number of little knobs carrying bristly hairs. These knobs, however, are absent at the hinder end of the second space on each side of the middle line, a feature which distinguishes our species from *Hylesinus minor*, a destructive Continental species.

Larva.—The larva or grub is about a quarter of an inch long when full grown, with a bent, fleshy, legless body, whitish in colour, and with a yellow-brown head with biting jaws.

Life-history.—The beetles that had issued in the previous autumn, along with others, come out of their winter quarters about the end of March in a very favourable season, and the beginning of April, later if the weather be not favourable. After pairing, the female, under cover of the bark scales, begins to excavate a gallery in some sickly pine or in felled or fallen timber, preferably of the genus Pinus. As a rule the place chosen has thick bark, but I have also taken the beetle at work where the bark was quite thin. The mother gallery is shaped like a golf-

club, the head of the club representing the place of entrance. It is made between the bark and the wood, the wood sometimes being slightly eaten into, but the whole gallery may in a thick-barked tree lie entirely in the bark. This tunnel measures three to four inches, but I have found one on measurement extending to eleven and a half inches. At intervals along the tunnel air-holes are made.

The female beetle lays 100 to 120 eggs, singly, in little niches cut right and left at intervals along the sides of her gallery. From these eggs hatch out grubs, which start to gnaw their tunnels at right angles to the parent tunnel, these larval galleries increasing gradually in width, in correspondence with the increase in size of the feeding grubs. When full-grown the grub pupates in a little cell (the larval tunnels and pupal-beds are in the bark) at the end of the tunnel; and after the resting stage the mature beetles eat their way out—exit-holes having the appearance of little shot-holes.

The length of the cycle, from the egg-laying until the escape of the adult beetle from the tree, varies with the weather and with the month in which the eggs are first laid. During spring and summer a little over eighty days may be taken as a fair average. In a recent breeding experiment with this beetle I took, on May 26, fifteen live piniperda and placed them in a cotton sack with a fresh pine log. This pine log was first paraffined at the cut ends, so as to retain the moisture as long as possible. On opening the sack on June 6 a quantity of bore-dust lying in the bottom of the sack evidenced the boring of the beetles, and promised a successful experiment. On August 5 I exposed by dissection a mother gallery, and found the mother dead at the end of it. Dissecting out the larval galleries I came on many plump larvæ, evidently full-grown; in another part of the log, some days later, pupæ were found. On August 20, mature beetles of the new brood started to come away, and this issue continued through September. The length of the cycle in this experiment was eighty-six days.

There may be two generations in the year, for beetles issuing in the month of June or early in July, as the result of eggs laid in the early spring, proceed to a new egg-laying, the adults from which appear in September and October. It must not be supposed, however, that the breeding and egg-laying are confined only to the early spring and to the month of June in the summer; but while these may represent the flight times of a considerable swarm, adult beetles may be found during any of the warmer months, and may proceed to egg-laying, so that it is possible to get eggs, young larvæ, better grown larvæ, pupæ, and adults all at the same moment.

Tracing out the life-cycle in one brood, the following might stand as a calendar in favourable weather conditions:—

Nov. 1901 to March 1902.	April and May.	June.	July.	Aug.	Sept.	Oct.
Beetles in winter quarters	Beetles Eggs Larvæ	Pupæ Beetles of first brood	Beetles Eggs Larvæ	Larvæ	Larvæ Pupæ Beetles of second brood	Beetles of second brood

The egg-stage lasts for fourteen to twenty days; the larval stage about eight weeks, and the pupal stage a fortnight or so.

That hundreds of larvæ tunnelling in the cambial region should cause the death of a tree is easy to understand. But the harm done by *H. piniperda* does not end here. The second generation of beetles, or those issuing in the late summer and autumn, make their way to the young shoots of the pine and bore into these—not for egg-laying but for feeding purposes. A little ring of resin marks the entrance-hole, and the beetle tunnels upwards in the pith. These bored shoots strew the ground in quantities after a gale, and in bad cases of attack the shape of the crown of the tree may be quite altered; indeed the scraggy straggling tops, the result of the beetle's borings in the shoots, have earned for piniperda the name of the forester or gardener.

Means of Prevention.

1. Cut out sickly trees and remove them from the wood. It is sickly trees that the beetle chooses for its egg-laying. Sound and vigorous trees only succumb to an overwhelming onset.

2. Carefully remove from the wood all felled or blown timber. One understands the difficulty and the inconvenience of having to remove blown-down timber after a great gale, but it cannot be too strongly insisted on that every felled or blown tree allowed to lie without removal is just a cordial invitation to piniperda and kindred beetles to come and use for breeding purposes. I have no hesitation in saying that a great deal of the spread and the loss occasioned by *H. piniperda* in the centre and north of Scotland are traceable to the severe "blow-downs" of some years ago, left unremoved.

Where complete removal may be impossible the felled or fallen stems should be barked.

Remedial Measures.

While some benefit will be derived by removing shoots bored for feeding purposes by the adults after pupation, care being taken that the beetles do not escape in the process, yet once the beetles have got to work no remedial measure can compare in efficiency with the system of "catch-trees" or traps. These "catch-trees" may be sickly pines standing in the forest and marked, or else trees felled here and there at intervals for the purpose. Such standing trees or felled unbarked logs will be chosen by the beetles for their egg-laying, and when these come to be barked at proper intervals, the whole of the enclosed brood in the larval stage can be burnt with the bark. There should be a series of such catch-trees from February or March right on till the autumn, a new series being prepared say every month. Great care must be taken to make the round of such traps at regular intervals (the fact that the life-cycle takes some eighty or so days to be completed will be the guide), else the remedy may prove worse than the disease.

That this system of catch-trees is of immense service I can testify from much experience of its use. In a piece of bark measuring 28 inches long by 12 inches broad, which I cut from one such trap-tree, I found thirty mother tunnels, and allowing 100 eggs for each, no fewer than 3000 beetles might have escaped from this piece alone.

In the north of Scotland during 1898 and again in 1899 this measure was, on my recommendation, adopted on a large scale, and with most satisfactory results.

Insect Enemies of Bark-Boring Beetles.

There are two beetles which prey on *H. piniperda* and similar bark-borers that should be spared and encouraged in our woods, namely, *Clerus formicarius* and *Rhizophagus depressus.*

CLERUS FORMICARIUS.

Clerus can scarcely be confused with any other beetle. It has a large black head and black antennæ with reddish-brown tips; the thorax is red and black; the abdomen is red at the base and black behind, with two well-marked white bands running transversely across the wing-covers.

The larva of Clerus is rosy red. The head is dark and is followed by twelve joints, of which the first three carry legs. The first joint is covered above with a horny plate, and the second and third have each two little horny spots; the last joint

of the larva is also covered with a horny shield, and ends in two little projections.

Clerus, both beetle and larva, feeds on the larvæ, pupæ, and adult beetles of species destructive to trees, the larva being able to tunnel into the bark in search of prey. Some time ago, when I was engaged in working out the habits of Clerus,[1] I introduced a live Clerus into a glass tube containing five live *Hylesinus palliatus*, a troublesome enemy to our pine, spruce, and larch. For a quarter of a minute Clerus ran up and down the inside of the glass and then pounced upon one of the Hylesinus, seizing it in the weak spot in its armour—viz., on the under surface where the head is jointed on to the thorax. I lifted the tube to examine the more closely what would follow, lens in hand, when the Clerus started to run up and down the sides of the tube, and though it lost its footing several times and fell to the bottom, never for a moment did it leave go its victim, whose antennæ were seen to be quivering nervously. At last, coming to rest, and propping itself up on its two hind legs, the Clerus held the Hylesinus up to its mouth by means of the four front legs. First of all the head of the victim was bent back and emptied by means of the jaws, and then the hind part of the body gutted in the same way. Finally, the wing covers were broken off and the wings torn to shreds.

Another evening in July I placed in one tube three live palliatus and one Clerus, and in another tube seven live palliatus and one Clerus. Examination next day showed that all three palliatus in the first tube had been devoured, and five out of the seven in the second tube were represented only by scattered fragments of their external parts.

In watching Clerus feed at different times, I noticed that the seizure of the prey was always at the same place—viz., between the head and the rest of the body. After a meal the beetle would spend some time in cleaning itself, pulling its front legs through its jaws and the front legs over the antennæ.

RHIZOPHAGUS DEPRESSUS.[2]

This narrow beetle measures only about one-eighth of an inch in length. It is bright rust red; the wing covers show, with a lens, finely-punctured striæ. The larva measures a little less than a quarter of an inch; the head and prothorax is reddish; all the succeeding segments are whitish on the apical half, and reddish for their basal half. The last joint of the body is red

[1] "On the Life-history and Habits of *Clerus formicarius*, Linn.," by R. Stewart MacDougall, M.A., D.Sc., F.R.S.E., in 'Royal Botanic Garden Notes,' 1900.

[2] "On the Life-history and Habits of *Rhizophagus depressus*, Fowler," by R. Stewart MacDougall, in 'Royal Botanic Garden Notes,' 1900.

brown, and has on its upper surface two distinct tubercles, and on its under side a small appendage used in progression.

Both beetle and larva live below the bark. In pine and spruce on many occasions I have taken both in the tunnels of various injurious species, the adult Rhizophagus moving about the galleries and the larva lying alongside of or attached to destructive grubs or pupæ. Two years ago I determined this useful beetle for a forester in charge of extensive woods in Aberdeenshire, and asked him — in connection with certain trap-trees that had been felled and allowed to lie as lures for *Hylesinus piniperda*—to make frequent examination of the trees for *Rhizophagus depressus.* These trap-trees were very successful in attracting for their egg-laying many *H. piniperda,* and later the forester wrote me to say that in such trees where *R. depressus* was plentiful nearly half of the eggs or larvæ of *H. piniperda* were destroyed.

Tortrix, or Retinia resinella.

Another enemy of the pine, concerning which I have received some complaints during the year, is the moth named above, whose caterpillars, boring into the shoots below the whorl of buds, cause an outflow of resin which dries into a gall, inside which the caterpillar lives.

There are two other small Retinia moths most troublesome in Scotland—viz., *Retinia buoliana* and *R. turionana,* both of which lay their eggs singly on the buds at the end of the pine branches, and the caterpillars on hatching bore into these and the young shoots, so that the whole symmetry of the attacked tree may be destroyed by the spoiling of the "leader" and lateral branches.

Retinia resinella has a somewhat different habit, its eggs being laid singly below the buds.

R. resinella is a very small moth, with dark brown fore-wings marked by fine lead-grey striations. The hind-wings are brown grey, with light grey fringes. The moths issue in early summer. The sixteen-legged caterpillar is yellow, with a light brown head.

Life-history.—From the egg laid below the whorl of buds the caterpillar hatches, and as a result of its boring through the bark an outflow of resin takes place. In the year of hatching the gall may grow to the size of a pea. After hibernating in this gall the caterpillar resumes its feeding in the next spring, and the gall becomes larger, reaching in the second year the size of a small nut. After a second winter passed in the gall, the caterpillar becomes a pupa, and the moth issues in the summer, the empty pupa case projecting from a hole in the gall marking

the place of exit. The generation is thus a two-yearly one, the moths not issuing as a rule until in the third year from the egg-laying.

It is chiefly poor plants that are affected, and the harm done by the caterpillar, whose galls are very common in the centre and north of Scotland, might not be serious if it were not for the fact that the work of the pest is often aggravated by the two more dangerous allies of the moth already mentioned.

The remedy is to remove the resin-galls as early as possible, always, of course, before the flight-time in spring of the third year, or indeed before the end of the second autumn, as sometimes the moth may issue then.

Agrotis segetum—the Turnip Moth, and Surface Caterpillars.

In many of the turnips sent to me in connection with my investigation into the root rot of turnips caused by *Pseudomonas destructans* (reported elsewhere in this volume), I found traces of the work of surface caterpillars, and in one case obtained in the turnip bulb itself specimens of the caterpillars of *Agrotis segetum* —the turnip moth. The caterpillars of this moth, with those of its near relation *Agrotis exclamationis*, the heart and dart moth, —the caterpillars of these two moths being with difficulty distinguishable,—are along with the caterpillars of *Agrotis (Tryphæna) pronuba*, the large yellow underwing moth, sometimes very destructive to "root" crops. All three moths are members of the family Noctuidæ, a family of night-flying moths, with dingy forewings, characterised amidst other tracery and figuring by a round and a kidney-shaped mark on each forewing.

The caterpillars are known as cut-worms, or surface caterpillars, because they, lying buried in the daytime in the soil round their food plants, may come to the surface at night and gnaw the plants through between root and stem.

Agrotis segetum, whose caterpillars are figured in my Report on the Turnip Disease, may be met with in greatest numbers in the month of June: the comparatively few moths that issue from the autumn chrysalids are according to Newman in many cases quite barren, and never able to proceed to an egg-laying.

The fore-wings of the male moth are pale-grey-brown in colour, those of the female somewhat darker. The hind-wings are pearly white, but in the female the hind margin is clouded. The antennæ—so often a mark of distinction between the sexes in the Lepidoptera—of the male are like a comb, in the female simple bristles.

The female moth lays her eggs in the summer-time near the roots of plants or on the lower leaves. The caterpillars do not confine their feeding to the plants of one Natural Order, but take turnips, cabbage, carrot, lettuce, mangel, and other field-crops and garden-plants. They are night feeders, hiding during the day in the ground.

Feeding more at the surface in the early stages of its life, the destructive caterpillar later goes deeper and invades the swollen tap-root of a turnip, in the gnawed-out hollow of which several may be found embedded. The caterpillar continues feeding into the autumn, and even during the winter if food be obtainable. The caterpillars when touched have a habit of rolling themselves into a ring. A full-grown caterpillar measures an inch and a half or over. It has a narrow, brown, scaly head; the body is greyish-brown, with light and dark longitudinal lines; the upper surface of the segments show four dark spots. The winter is generally passed in the soil in the caterpillar stage, pupation taking place in the following May in a cell in the soil, the pupa being smooth and brown. The mature moths issue in June and onwards.

Preventive and Remedial Measures.

Procedure against these pests is troublesome and not always very successful, but the following is a summary of the methods:—

1. Trapping the moths during the summer. The moths are attracted by lights and are fond of sweets. The principle of such a trap is the arrangement, near a lighted lamp, of some surface smeared over with a sweet treacle. This is a favourite method of trapping practised by the insect collector, and it is beyond doubt that many moths can be so caught. The drawbacks are that this could only be practised in a very circumscribed area, and useful parasitic insects, equally it may be lovers of sweets, would also be trapped.

2. Handpicking the caterpillars. Workers, provided with a lantern and armed with a blunt knife or a pointed piece of wood, make a round of the plants at night and dig up and collect the cut-worms. On a small scale this measure, though tedious, can be very effective.

3. Disturbance and destruction of the caterpillars by harrows in the case of young roots and the similar frequent working of the soil during winter and spring. Caterpillars or pupæ escaping death by crushing would be exposed to such birds as rooks, gulls, starlings, lapwings.

4. Making the surroundings of the plants distasteful to the caterpillars by sprinkling the bases of the stems with fresh

finely-powdered soot or soot and lime. This method has been successfully practised in the case of the cabbage crop.

5. In America there are numerous records of successful experiments by poisoning the caterpillars. This is done in one of two ways. Either, first, by mixing bran and Paris green (50 lb. of bran to 1 lb. of Paris green, mixed when dry and then slightly wetted with water sweetened with sugar), the bran mash then being spread in spoonfuls along the rows at the bases of the plants, or preferably before the plants have come up, as then the cut-worms will be most hungry; or, second, by spraying clover and grass, or weeds or other plants, with Paris green (1 lb. of Paris green to 50 gallons of water, the mixture to be kept well stirred), and fastening these sprayed plants into bundles to be distributed here and there at intervals amongst the crop. In both cases the Paris green would kill the caterpillars. One can imagine circumstances in which with us this plan might be tried, but the experimenter must never forget that Paris green is a dangerous poison—it must not be inhaled nor allowed, say, to get into cuts in the hand—and that there is a risk to poultry or other animals that may invade the place of experiment.

6. Professor Slingerland,[1] an American authority, in suggesting the wisdom of sowing plenty of seed where an infestation of cut-worms is expected, quotes the old saying—

> "One for the blackbird, and one for the crow,
> Two for the cut-worm, and three to grow."

The wisdom of this course, however, which is recommended sometimes also in the case of the wire-worm, is doubtful, as the farmer may, even if he escape one year, be only putting a rod in pickle for future scourgings.

PLUTELLA CRUCIFERARUM—THE DIAMOND-BACK MOTH.

In July of the past year and onwards the caterpillars of the above moth did a very great deal of damage to the leafage of turnips and swedes. Rain is a factor which keeps this pest—specimens of which can always be got in our turnip-fields—within smaller numbers, and the prolonged drought of last summer greatly favoured the increase of the diamond-back moth.

Complaints reached me from the east of Scotland and the north of England, and when going over some turnip-fields near Lockerbie in the beginning of August, I found the pest extremely abundant and in all stages of development. At every step we started the little moths on their somewhat jerky flight,

[1] Climbing Cut-worms in Western New York. By M. V. Slingerland, Cornell Univ. Agric. Experiment Station, Bulletin 104, November 1895.

while on the same plants could be found feeding caterpillars and spun cocoons. Caterpillars collected in the fields on August 2 pupated with me on August 6, and new moths started to come away on August 20.

The moth measures only half an inch in length, as it rests, with wings covering the back and somewhat tilted up at the ends. From the yellow-white head the antennæ project straight forwards. The prevailing colour is grey-brown. The hind edge of each fore-wing has three white marks, and these, on the edges of the wings being brought together when the moth is at rest, give the diamond-shaped figures which have earned for the moth its popular name.

Life-history.—The yellow-white eggs are laid on wild Crucifer plants and some others, the later moths laying on the under side of cultivated Crucifers, such as turnip and swedes, whose leaves may soon be riddled by the hatched-out caterpillars or left only with the larger veins. When full-grown the caterpillar becomes a pupa in a whitish-woolly cocoon attached to the under-surface of the leaves of the food-plant.

Remedial Measures.

1. The destruction of Crucifer weeds will lessen the food plants on which the earliest moths of the year can lay.

2. To dislodge the caterpillars drag furze or other branches across the turnips, taking care that the under sides of the leaves are reached, and then follow with the "scuffler" (or the branches can be attached to the front of the scuffler) so as to bury the fallen caterpillars.

3. Thoroughly dress the plants with a mixture of soot and lime (one part lime to three of soot).

4. Spray with paraffin emulsion, the spraying to be done with a machine such that the under sides of the leaf may be reached.

WEEVILS DESTRUCTIVE TO STORED GRAIN.

During the year one of the members of the Society wrote to me as to an insect infestation in a grain store. On examination the insects proved to be *Sitophilus* (*Calandra*) *granaria,* one of the weevils which, especially abroad, work immense damage to stored grain. The other weevil is *Sitophila oryzæ.*

In a communication in 1888 on the Wheat and Rice Weevil in India, Mr Cotes, the author, writes: "The amount of loss occasioned by the weevil in India every year is estimated at an average of 2½ per cent, the maximum being 5 per cent and the minimum 1 per cent. Taking the value of wheat exported at £6,000,000, the annual loss occasioned by weevil in exported

wheat alone is £150,000. This sum, however, in reality represents but a fraction of the real loss, as it does not take into account the damage done to wheat consumed in the country, or any of the loss occasioned to rice, which is also attacked by the same weevil, besides the loss indirectly occasioned owing to the difficulty of storing the grain."

Again, in another case reported in the Transactions of the London Entomological Society, 1870, 10 cwt. of weevils were screened from 74 tons of Spanish wheat, and 85 cwt. of weevils from 145 tons of American maize.

Sitophilus granaria is one-eighth of an inch long, with the head end prolonged into the snout or proboscis, characteristic of the weevil family. In colour the beetles are brownish-black; the kneed antennæ which spring from the snout are reddish, as also are the six legs. Examined with a hand-lens the thorax is seen to be covered with dots, and the wing-covers are striated. The grubs are whitish, legless, with brown heads and biting jaws. All the stages—egg, larva, and pupa—are passed inside the grain, and from it the mature beetle steps out to use other grains for food material or breeding purposes.

Each female lays a large number of eggs, one to each grain (in the smaller grains at least). If for some reason or other several eggs be laid in one grain, only one adult beetle, and this an undersized one, may emerge, as there has not been food sufficient to develop the other grubs. The hole made in the grain for the reception of the egg is afterwards closed by a plug of closely-pressed meal. When the grub hatches it proceeds to nourish itself on the contents of the grain, and inside the hollowed grain the full-fed grub pupates. The length of the life-cycle depends on the temperature.

How to rid the Grain of the Pests.

By sieving or screening.—The infested grain is run through a sieve or down a screen whose meshwork is sufficiently fine to keep the grains back and yet let the beetles run through, these being caught in a vessel arranged below for the purpose, and containing paraffin.

2. *Fumigation.*—Nothing approaches in serviceableness for this purpose bisulphide of carbon. This is a magnificent insecticide. I have killed a hundred moths and as many cockchafers in a few minutes, simply by placing these in an air-tight box along with a plug of cotton-wool, previously dipped in bisulphide of carbon.

Bisulphide of carbon has an evil smell, and the fumes are quickly fatal to insect and other animal life. A person using it should not inhale more than he can help, and he must be

especially careful not to bring any light near it: he must not be smoking even at the time of use, or an explosion may follow. The substance is so inflammable that prolonged exposure to a powerful sun may cause it to ignite. At the same time, with careful use there is no danger.

The liquid volatilises readily, and the vapour, which is heavier than air, sinks. To use the bisulphide against these weevils one places the grain to be treated in a bin or air-tight chamber, and then lays on the top of it a shallow vessel or vessels large enough to hold a pound of the insecticide. The fumes sink through the grain and kill the insects present. Two lb. of bisulphide of carbon are sufficient to fumigate 1 ton of grain. In disinfecting a store or a mill, 1 lb. of the substance is sufficient per 1000 cubic feet of space.

3. In the literature there is general agreement as to the fatal effects of cold on these weevils. A warm temperature is necessary for their breeding, and in our climate in winter thorough ventilation and exposure in a cold place of storage will kill out the pests. In the month of September I obtained a large sample of grain infested with *S. granaria*. The mature beetles began to come away from the grain during the month, and as they issued I placed them under a bell jar with a supply of wheat, oat, barley, and rye grains for food, in a room kept without a fire. During October and the first half of November the beetles continued to move about freely, but by December all had died.

Sitophilus oryzæ is somewhat smaller than *granaria*, is scarcely so dark, and has two light patches on each wing-cover.

HYPONOMEUTA PADELLUS—THE SMALL ERMINE MOTH.

In June of 1901 I was written to concerning a severe attack by the caterpillars of the above moth on apple-trees, the crab apple and the bird cherry. The caterpillars were well known as regular feeders on the bird cherry, these trees growing wild in great numbers in the district whence the complaint came from; but the fine spring and summer of 1901 was all in favour of insect life, and the small Ermine caterpillars invaded in immense numbers the orchard and the garden, where they did much harm. The apple-trees were stripped of their leaves, and the young apples fell off as a consequence, and although, after the full-grown caterpillars had spun their cocoons, the trees reclothed themselves with leaves, there was a great shortage in the crop. In addition the trees were rendered unsightly by being covered with the dirty-coloured ragged webs so characteristic of this insect.

The moths are small, measuring three-fourths of an inch in spread of wings. The front wings are light grey in colour,

dotted over with black spots, and the hind wings are dark grey or lead-coloured.

The caterpillar is greenish-grey with black spots; the head is black.

Life-history.—The moths appear in June and July, and lay their eggs on the twigs in clusters. Under cover of a coating of a gummy material the eggs may hatch in the same year, but it is not until the spring of the following year that the young caterpillars begin to feed on the leaves. The caterpillars are social, living together in companies in webs spun by them. If the web be disturbed the caterpillars can spin down on threads, climbing back after a time. When full-grown the cocoons are made under cover of the web, many together.

Remedial Measures.

1. Shaking the moths down from the trees on which they rest during the day, on to cloths spread below to catch them.
2. On a small scale hand-picking or cutting off web-infested twigs or crushing the webs so as to kill the contained brood.
3. Spraying the webs and the caterpillars with paraffin emulsion. This will need to be done carefully, for it will be found difficult to penetrate the webs. The earlier the spraying can be done the better, the webs not being so numerous nor so thick, and the caterpillars being smaller.

My correspondent, dissatisfied with the result of a paraffin spray which he had been using, made up a strong solution of M'Dougall's Sheep Dip, and in this way killed thousands of caterpillars, the webs turning yellow. The caterpillars which were not killed collected at the foot of the tree or under a big branch, and these were easily accounted for. The difficulty is not to kill the caterpillars but to reach them through the web.

The solution of sheep dip, however, had to be used with great care, as leaves sprayed by it turned black and dropped off, and there was the risk of killing the tree.

Anobium Domesticum in Furniture.

During the year an inquiry reached me as to some insects which were boring in furniture, sawdust and meal in little heaps marking the work of the borers. On examination the pest proved to be *Anobium domesticum,* one of the so-called death-watches.

The family Anobiidæ includes small but destructive beetles. Many live in the open, the larvæ boring into old stems or young shrubs, while one species is destructive to the cones of needle-

leaf trees. The indoor species are destructive to furniture, books, and eatables.

Anobium domesticum, which, along with *Anobium striatum* and *Anobium tesselatum*, does harm to dry timber, chairs, tables, bookcases, &c., is a brownish beetle measuring one-sixth of an inch. A lens shows the wing-covers to be furrowed and covered with short hairs. These beetles, whose head can be withdrawn into the thorax, feign death on being touched, by tucking in their heads and contracting their legs, in which position they can be touched or even roughly handled without responsive signs of life.

Life-history.—The beetles bore into the wood and lay their eggs, from which hatch whitish fleshy wrinkled grubs with gnawing jaws and six small legs at the front end. These gnaw the wood, causing the tunnelled and powdery appearance well known to those who have broken across a piece of such attacked wood. When full-grown they become pupæ in the burrows in a cocoon of soft silky material mixed with wood-meal.

The above beetles have received the name of death-watches for the following reason: They have a habit at pairing time, and as a sort of call-note, of knocking their harder head parts against the wood, the tapping of one insect being replied to by another; indeed there are records of enclosed beetles responding to the gentle tapping of a lead pencil. Such sounds are not so likely to be heard in the house during the busy day, but at night when mostly silence reigns. Sick and nervous people, unable to sleep, would be the likeliest to hear and exaggerate the meaning of the sounds, and so a maze of superstition has grown round the noises, which were considered to be warnings of an approaching end, just as the death's-head moth is said to whisper into the ears of some for whom the tomb is about to open. Hence the poet Gay tells how—

> "The solemn death-watch ticked the hour she died."

But let Gay be answered by the more prosaic Swift—

> "A kettle of scalding hot water ejected
> Infallibly cures the timber affected;
> The omen is broken, the danger is over,
> The maggot will die and the sick will recover."

As to *remedies*, recommendations are varied. If infestation be bad in one piece of furniture, it is likely to spread to another piece, therefore remove the infested article.

Benzine squirted into the burrows, by means of the holes which show outside, will account for beetle and grub: so too would bisulphide of carbon, or a dilute solution of corrosive

sublimate (a dangerous poison). Paraffin oil would be equally serviceable.

I have in my notes on these beetles an old record showing that 15s. had been paid to a firm of wood-carvers for "destroying 'worms' in a wooden bust of John Wesley." While this bust had stood in chapel, Anobium had attacked it, and the workman, to whom the bust was handed over for treatment, got rid of the pest by placing the bust for some weeks in a bath of paraffin oil, afterwards making the following entry in his time-sheet,— "'To rebaptising John Wesley and curing him of worms,' so many hours, so much!"

DISEASE IN TURNIPS AND SWEDES.

Investigation by Dr R. Stewart MacDougall, M.A., Consulting Entomologist to the Society.

Towards the end of August 1900 my attention was called to a disease which was proving most destructive to swedes and turnips in the south of Scotland. The disease—whatever it was—had been noticed for some seasons without much attention being paid to it, but latterly it had occasioned very serious loss. I visited several farms in Dumfriesshire and Kirkcudbright, and had opportunity of seeing the infested plants and carrying away material for more careful and minuter examination than one could give in the fields.

Characteristics of the attacked Plants.

At an early stage in the growth of the turnip or swede the leaves of the plant may begin to die away. Leaf-stalks and blades turn yellow, droop, and fall. The fallen leaves may remain attached for a time by their withered bases, the blades trailing on the ground, but later the whole shaw separates, leaving the swollen top exposed, so that patches of the field may look—to quote two of my correspondents—"as if a horse had tramped on the plants," or "as if a lot of sheep had been lying on them."

The plants do not give way without an effort at recovery, and so in association with this leaf-destruction very often a number of axillary buds develop, sending out new leaves, and the turnips become "double-shawed" or "cabbage-headed."

Associated with and causing this loss of leaf (a loss which by itself would affect the size and value of the future turnip or swede) there is a rotting of the tuber; the crown or

apical part shows a hollow, and as the disease spreads this enlarges; the cells break down; the tissues are disorganised; on section the cut surface appears glossy and pale in colour; and at last on a finger or walking-stick being pushed into the hole at the crown the rotting mass squirts out; the bulb is completely destroyed.

A bad smell comes from the the diseased turnips. Plants left under cover in the laboratory over-night had to be removed next day.

Chances of recovery.

Attacked plants do not always succumb. For example, on a farm near Lockerbie the owner in July of this year had begun to despair of his crop, but in August there was a distinct and lasting improvement. I find, however, in the South, that recovered surviving bulbs are not in great favour, for two reasons —first, they are stringy and dry; and second, they do not make good keepers.

Possible causes of the Disease.

These seemed to be four—viz., the soil and climatic conditions, a mycelium-possessing fungus, bacteria, insects.

The first of these four could be dismissed at once. The disease was worst in districts that prided themselves on their successful growing of turnips and swedes, and that could show in past seasons very heavy crops per acre.

As to fungi, the most careful examination under the microscope of scores of sections made from plants collected by myself or sent to me from different districts failed to reveal, as a possible cause of the rot, any fungus possessing the characteristic thread-like mycelium seen in fig. 79. This figure shows some cells of the turnip from a thin slice made through a turnip bulb with a razor and greatly magnified. Running

Fig. 79.—*Part of a slice through a turnip attacked by bacteria. At a later period, when the turnip had been allowed to lie, this other fungus attacked it.*

The dark lines are the walls of turnip cells. The thread of a fungus is shown as having eaten its way through the cell-wall The dots are bacteria. The drawing is made from one of my sections under a magnification of about a thousand.

through the cells and between the walls is the hypha of a fungus which, judging from other sections I have made, I take to be a Pythium. Most fungi in their vegetative state possess this thread-like structure. The genus Brassica has a number of such fungus enemies, but to none of these could the disease in question be ascribed.

There remained the insect and the bacterium hypotheses, and it is interesting that while satisfying myself that a bacterium, *Pseudomonas destructans* as Professor Potter has named it, is the cause of the White Rot in turnips, I should during the investigation and proof find another new enemy of our Crucifer plants in the shape of a dipterous insect. One is sorry to have to chronicle a new enemy to a crop which seems already to have enemies enough, but the farmer has multiplied his turnips and swedes, and nature will not be cheated, for "wheresoever the carcass is there will the eagles be gathered together."

In what follows, while my argument is that this dipterous maggot is in many cases the preparer of the way for the bacterium which ruins the turnip or swede, I must not be supposed to hold that there can be no bacterial disease without the presence of this special insect enemy. To make this clearer I may partly classify the plants collected by me or sent to me under the following heads:—

a. Those attacked in the young stage by the dipterous insect and killed.
b. Those attacked by the dipterous insect and survived.
c. Those which were attacked by the dipterous insect and later by the bacterium, and so were ruined.
d. Those injured by insect other than the new dipterous insect, and later killed by the bacterium.
e. Bulbs ruined by the bacterium and showing no signs of other injury.
f. Turnips which had succumbed to combined finger-and-toe and bacterial rot.

Bacteria: their Structure, Life, and Work.

A bacterium is a one-celled plant, a simple droplet of living matter surrounded by a wall. In size they are very minute, some of the smallest being no more than $\frac{1}{25000}$ inch in size, therefore our knowledge of them dates only from the perfecting of the compound microscope.

There are three type forms—the round or coccus, the rod-like or bacillus, and the spiral or bent. Indeed, De Bary has said that for the demonstration of bacterial form all one needs is a billiard-ball, a lead pencil, and a cork-screw. These

bacteria may have projecting cilia by which they can lash themselves about actively, say towards oxygen or food material.

Their method of multiplication is extremely simple. Living in happy environment, each cell grows and then divides into two: in favourable circumstances increase by this splitting mode of multiplication is very rapid. If circumstances of food, temperature, &c., be unfavourable, the bacterium may form spores—*i.e.*, the living matter within a cell contracts and surrounds itself with a protective wall, and these spores are extremely resistant to external conditions which would soon kill the ordinary vegetative form of the bacterium. When the environment once more becomes favourable the spore "germinates," resuming the life of an ordinary bacterial cell.

Conditions of Life of Bacteria.

Very important are temperature and oxygen.

Bacteria differ in the degree of temperature most favourable for their growth, according to their habit and place of living: *e.g.*, those bacteria which live in the inner part of animal organisms are more sensitive to changes in temperature than, say, forms which live in the soil. Speaking generally, we may say that a temperature of 41° F. is the minimum below which a growth and spread of bacteria can no longer take place; 77° F. to about 100° F. represents the most favourable temperature for many common forms; while subjected to a temperature of 122° F. to 140° F. for a considerable time death would follow—*i.e.*, death of the ordinary bacterium but not of the spore. Spores may stand out against boiling for two to three hours, and in dry heat are first killed at 266° F. to 284° F. Fortunately spores are not common in the bacteria that cause diseases in men.

As to oxygen, the great majority of bacteria cannot thrive in its absence, some being very sensitive in this respect; to a few oxygen is a poison.

Ozone is an excellent disinfectant—*e.g.*, if water is polluted, ozone can be introduced with excellent results.

Moisture.—For the normal life of bacteria moisture is necessary. About 80 per cent of their cell-substance is water. If moisture be absent, then the vital activity of the bacterium ceases, and if this absence continue some time the vegetative cells die: *e.g.*, the cholera bacillus air-dried dies in three hours, the tubercle bacillus in some weeks and longer. Spores, however, can stand out against prolonged dessication.

Light.—Most bacteria can develop only in the dark or in diffuse light. Direct sunlight kills, and often rapidly: *e.g.*, the

bacillus of typhoid fever is killed in half an hour to two hours, the diphtheria bacillus in one hour.

Food.—Bacteria being plants—*i.e.*, living things—require food like other living things. As a general rule, too, they flourish best in a medium which is neutral or slightly alkaline. In a strongly acid medium the vital activities are brought to a standstill. The soil is the great resting-place and source of supply of bacteria, these reaching the air by various natural agencies. The greatest bacterial richness is in the surface layers, deeper than 20 inches their number greatly decreases. Not only do bacteria at greater depths fail to find the necessary conditions for their active life, but the soil acts as a bacterial filter. In an average of three experiments, with the same soil, Kramer found in 15 grains of earth—

	Germs.
At a depth of about 8 inches . .	650,000
" " 20 " . .	500,000
" " 28 " . .	276,000
" " 39 " . .	36,000
" " 47 " . .	5,600
" " 55 " . .	700
" " 64 " . .	only a few.

Of course the number of bacteria present will vary with the environment, with whether soils are cultivated or non-cultivated or in inhabited places.

Results of the Work of Bacteria.

These are very varied. In the following, bacteria play a role:—

a. *Putrefaction.*—Dead organic matter is seized upon by bacteria, and as a result is broken up into simple principles.

b. *Nitrification.*—Tillage is no longer looked upon as a mechanical thing, but it is recognised that by it many of the conditions are produced under which certain soil bacteria are able to act as manufacturers of nitrates from substances that are present in the soil as a result of the decomposition of organic nitrogenous bodies manurial or other.

c. *Fixing of the nitrogen of the air.*—The bacteria of Leguminosæ live in partnership with the plant, fixing free nitrogen, and handing it on to the plant.

d. *Fermentation.*—Useful or harmful, according to the observer's purpose or attitude; such fermentations as the acetic fermentation with the production of vinegar; lactic fermentation, causing say a sourness of milk; butyric fermentation.

e. *Causing disease* in animals and plants.

Useful and Harmful Bacteria.

From the above summary of the results of their work it will be seen that there are two sides to the question. Taking a broad view, it may be said that amongst the myriads of bacteria the useful forms outweigh in number and importance the harmful, although these latter by their more easily observed action thrust themselves more on our notice. If animal and plant diseases be caused by some bacteria, it is equally true that a normal and healthy animal or plant life is impossible in absence of others; the denitrifying organisms, causing by their decomposition of nitrates a loss of nitrogen, are more than counterbalanced by the nitrifying bacteria and the bacteria of Leguminosæ; milk is certainly soured by some bacteria, and butter spoilt, but equally in absence of others butter will lack its flavour and cheese will not ripen; to the butyric acid fermentation in milk can be opposed other and useful fermentations; and if meat does become tainted under the action of putrefactive germs, we cannot forget that in absence of putrefaction not only would the earth be encumbered with the remains of all the dead animals and plants, but that the presence of the simpler elements and principles that are the products of such decomposition is necessary for life itself.

Plant Diseases due to Bacteria.

While the diseases in plants due to fungi are exceedingly numerous, those caused by bacteria—which are sometimes called fission or splitting fungi, from their method of multiplication—are in proportion exceedingly few. They can almost be counted on the fingers of the hand if we rule out of court those diseases said to be due to bacteria, but where there is no experimental evidence of the ability to communicate the disease to the plants concerned by means of infection from prepared cultures.

I give examples culled from the literature of the subject.[1]

Hyacinth.—There is a decay of the hyacinth bulbs, the disease showing itself in the bulb and spreading to the leaf. The leaves fall away, and the tissues break down to a bad-smelling pulp. Experimentally the disease has been produced in healthy plants by bacilli, from cultures being placed on the bases of the leaves.

Apple and Pear.—A disease known for long in America has been found attacking pears and apples, both in the wild condition and in orchards. The bark of the tree is attacked, a dark-coloured fluid exudes from dead patches on twig and branch,

[1] A Text-Book of Plant Diseases, by George Massee (Duckworth & Co.); Diseases of Plants (Tubeuf & Smith), (Longmans & Co.)

and the leaves brown and tumble away. The disease shows itself in patches, and the treatment is that adopted by the surgeon in the case of a diseased part—the colonies of bacteria are carefully cut out.

Mulberry.—The leaves of the mulberry sometimes show brown spots, and from the diseased leaves a bacterium has been isolated which, placed on a healthy leaf, produced the disease.

Sorghum saccharatum.—This American plant, from which sugar is obtained, sometimes dies from bacterial attack on leaf and stem. The remedy is the burning of the stubble.

Potato "Wet Rot."—This is a disease affecting the tuber in warm wet seasons: beginning in patches below the jacket, the tuber ends by being reduced to a mass of brown slime. By some, bacteria are blamed, while others, looking upon the bacteria as the effect and not the cause, believe that the way is opened up for the bacteria by preliminary infestation by the fungus *Rhizoctinia solani.*

Brown Rot of Tomato and Potato.—In this disease, worked out by Dr E. F. Smith,[1] the enemy is *Bacillus solanacearum*, an oval bacillus measuring 1·5 micro by 0·5 micro (a micro $= \frac{1}{25000}$ inch). Attack is attended by a wilting of the foliage and, in the case of young non-woody plants, by a complete shrivelling of the stem. In the potato the disease spreads to the tuber, which rots.

Cucumber.—*Bacillus tracheiphilus* (so-called because it infests the conducting vessels or tracheæ of the plant) is the cause of wilting in cucumbers.

Rot of Cabbage.—This disease, also investigated by Dr E. F. Smith, is caused by the bacterium *Pseudomonas campestris.* The bacterium gains entry to the plant through pores at the edge of the leaf, called water stomata. I have not been able to get the original paper, but quote Massee's[2] excerpt from Smith :—"This disease may appear in the plant at any stage of growth, and is characterised by the following symptoms: Dwarfing, or one-sided growth of the heads, or, if the disease is very severe and has begun early in the season, by the entire absence of any heads, and in extreme cases by the death of the plant. Occasionally the heads rot and fall off, but this is not a necessary consequence, the soft, bad-smelling rot being due to the entrance of other organisms."

During the course of my investigation I heard that a good deal of destruction had been done to cabbage by a rot, concerning which some communication was made in the Press by Mr Service, Maxwelltown. I wrote Mr Service for material for examination, but, unfortunately, material was no longer

[1] U.S. Dept. Agr. Division of Vegetable Physiology and Pathology, Bull. 12.
[2] Text-Book of Plant Diseases, by George Massee.

available. In a letter in reply to queries of mine Mr Service says: "The disease in the cabbage was seen as a 'spreading rot' at or near the surface of the soil, round the neck or collar of the plants, causing them to wither suddenly under the hot sunshine. The stems quickly became a mass of rotten fibres. If the stumps of affected plants are broken or cut across, a brown or black ring will be observed, corresponding to the woody part of the stem, this being the part of the stem specially subject to the disease. In bad cases this blackening may be easily traced upwards into the centre of the head, and is generally worst on one side. In the leaves the symptoms usually begin at the margins, and consist in yellowing of all affected parts except the veins, which become decidedly brown or black. The leaves appear to have burnt edges."

White Rot of Carrot.—Recently I have read[1] an account of white rot in carrot produced by a new bacterium named *Bacillus carotovorus.* The observations were made in Vermont, U.S.A. When the carrots were harvested, a diseased carrot was noticed here and there. On being placed in store in a cellar the rot spread rapidly, and by early winter nearly all the roots had perished. The disease attacked the crown, and penetrated the root rapidly. Cultures were made of a bacillus which, placed on carrot, quickly produced the disease. The bacteria were found in the spaces between the cells, and by their action the middle lamella (the central part of the common wall of cells) was dissolved. This dissolving of the cell-walls is suspected to be due to a ferment, like cytase. The following other plants in different Natural Orders from the carrot were rendered diseased by inoculation of the bacterium from the carrot—white beet, swede, cabbage, radish, parsnip, salsify, onion bulbs. In making the inoculation experiments it was found necessary sometimes to keep the material moist, as when the material dried the disease was checked. How like in many respects this is to our Turnip Rot will appear later.

The Bacterium of Turnip White Rot (*Pseudomonas destructans*, Potter).

The bacteria consists of extremely minute short rods with rounded ends. These rods are motile: on placing a little material from my cultures of Pseudomonas in a drop of water and magnifying under the microscope, the bacteria could be seen moving actively about, but it was another matter to see the cilium or flagellum or lasher that gave rise to the movement. At last, after many attempts and the use of various

[1] U.S. Dept. Agr. Experiment Station Record, vol. xiii. No. 4, 1901.

"stains," success was attained, and fig. 80 is a drawing from one of my preparations of some of these bacteria and the flagellum which projects from one end.

How the Pseudomonas was isolated and grown.

In order to test the *bacterium hypothesis* mentioned earlier in this report, I took plants showing the characteristic appearance associated with the disease: these had been collected by myself in the South of Scotland. The first problem that presented itself was to isolate if possible from the material the disease-causing germ. In the attempt to do this the following was the method adopted. Let me explain here that whenever I use the term "gelatine tube" I mean a glass tube containing specially prepared "broth," made of materials on which the bacteria to be sown or planted could feed; bacteria, being plants, could not be expected to live and grow without food. Such tubes, too, have a plug of cotton-wool, which, acting as a filter, prevents the access of other bacteria which would vitiate the experiment. I will also write as if nothing ever appeared in my culture experiments save the Pseudomonas, other bacteria or yeasts not being introduced because they have no bearing on the final result.

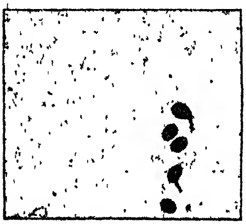

Fig. 80.—*Bacteria from one of my cultures.* Magnified 2250 times.

The first stages, then, in the process were these:—

a. A tube containing liquefied broth was taken.

b. A fresh surface was cut in one of the diseased turnips with a sterilised knife.

c. Into the exposed "rot" material of the turnip a platinum needle, previously sterilised by having been held for some time red hot in a flame, was dipped.

d. The plug of cotton-wool was momentarily removed from the tube mentioned in *a*, and the platinum needle dipped into it, so that the material obtained from the rotten turnip might be washed off in the "broth."

e. As tube *a* would now likely contain (this is known from the practice) far more material than could be conveniently managed, another tube (tube *b*) containing liquefied broth was taken, the plug removed, and the again sterilised needle dipped into tube *a* and then at once dipped into the broth of tube *b*, which was immediately plugged. In this second "dipping," naturally much less material was introduced than in the first "dipping," and it was hoped with successful results.

f. Meanwhile a "petri-capsule" had been prepared—*i.e.*, a completely sterilised chamber (a jar, for example, washed out with a solution of corrosive sublimate and covered by a lid similarly treated). The contents of tube *b* were then poured out over a "plate" resting in the "petri-capsule." The whole was then placed in a suitable temperature away from the light. Some days later, on this plate being examined, it showed amongst other growths a number of tiny round whitish colonies which proved to be colonies of the Pseudomonas.

How additional or sufficient material was got for inoculation experiments will be understood if I say that we grew the bacteria by making use of "gelatine tubes" containing broth that, after being introduced into the tubes, had been allowed to solidify by standing in the cold. The end of a sterilised platinum needle was dipped into one of the colonies mentioned above, and then the cotton-wool plug of a tube being temporarily removed, a "stab" was made into the "jelly" and the tube sealed up. The bacteria introduced in this way—*i.e.*, planted in a congenial soil—grew at the expense of the food materials. The material could be multiplied at will by inoculating other tubes from those already containing a growth of the bacterium. Some of these tubes I distributed for demonstration purposes.

In making these cultures the importance of oxygen to the bacterium, and its influence on the rapidity of bacterial growth, was illustrated in an interesting way.

Let the reader imagine two of these "gelatine tubes," a little more than half an inch in diameter. Some liquid nutrient broth was placed in each. After plugging, the contents of the tube were left to solidify—one tube being supported during solidification in the erect position, another being placed in an inclined position. It will be clear that on solidification there would in the erect tube be a surface exposed to the air of the tube equal only to the diameter of the tube, whereas in the other there would be a much larger surface of solidified "jelly" so exposed.

Now, in my experiments, on inoculating tubes I used sometimes the "erect" tube and sometimes the "inclined" one. In inoculating a tube that had remained erect during solidification, the platinum needle, after being dipped into a culture of Pseudomonas, was "stabbed" into the "jelly"; in the case of the other sort of tube, a "stroke" was made along the surface with the platinum needle. The difference in the rapidity of growth of the respective cultures was very marked. In the case of the "stab" there could be seen a line marking the track of the platinum needle, and this at the exposed surface broadened out into a circular patch; in the case of the "stroke" the growth

was rapid and great and equal. After growing for some time the "gelatine" is liquefied by the action of the bacteria.

Proof that this isolated Bacterium was the Cause of the Disease.

Although a bacterium had been isolated and grown in pure cultures in the way described, it remained still to prove that this bacterium was the cause of the rot. The proof was afforded by inoculating—*i.e.*, by bringing into contact some of the bacteria from a culture and a healthy plant, the disease following as a consequence. My method was twofold.

First, I prepared "petri-capsules," and then took a fresh turnip, chosen from the fields by myself; the outside of this turnip I washed with a weak solution of corrosive sublimate (mercuric chloride), then with a sterilised knife I exposed a fresh surface and cut from it several blocks. These blocks were placed in the "petri-capsules" duly supported, and inoculated by bacteria from one of my cultures. In due course thin microtomed sections through the pieces of turnip showed under the microscope the cells to be invaded by the bacteria.

Again, through the courtesy of Professor Bayley Balfour, a number of plants had been grown in a plot at the Royal Botanic Garden. Choosing plants in the plot, I removed from the sides of some, by means of a sterilised "cheese tester," little plugs of tuber, and introduced, by means of a sterilised needle or sterilised pipette, bacteria from my cultures—rot following Fig. 81 is a cell from a section through such a piece of tuber, greatly magnified: the section was made through a piece of tuber below the surface exposed by the "cheese tester." The bacteria are seen in the cell, whose contents have become disorganised.

Prior Work on Brassica Rot.

While I was working at the Rot of Turnips and Swedes, papers appeared on the subject by Messrs Carruthers and A. Lorrain Smith,[1] and by Professor Potter.[2] Through the courtesy of the Secretary of the Highland and Agricultural Society, I had also the pleasure of meeting Mr Carruthers in the spring of 1901, and discussing the disease with him.

Messrs Carruthers and Smith figure the bacterium, and note in their paper the rapidity with which the disease may spread. Mention, too, is made of a field in Yorkshire, 25 acres in

[1] Messrs W. Carruthers, F.R.S., and A. Lorrain Smith, in 'The Journal of Botany,' Jan. 1901.

[2] "On a Bacterial Disease of the Turnip," by M. C. Potter, M.A. (University of Durham Philosophical Society, 1899). "On a Bacterial Disease of the Turnip," by M. C. Potter, M.A., F.L.S. ('Proceedings of the Royal Society,' vol. lxvii.)

extent, where not one turnip in five seemed to have escaped. It is noted, too, that "at a late period the progress of the disease was to a large extent arrested. This no doubt arose from the destruction of so many leaves, which left the rows somewhat bare. Sunlight and air gained free access to the bulbs, and the bacteria were dried up and destroyed."

The authors attach little value to the reparation power that might follow the development of new buds. The reader will have noted what I said earlier in this report on the influences of light in the destruction of bacteria, and I agree with Messrs Carruthers and Smith in their belief that light gaining free

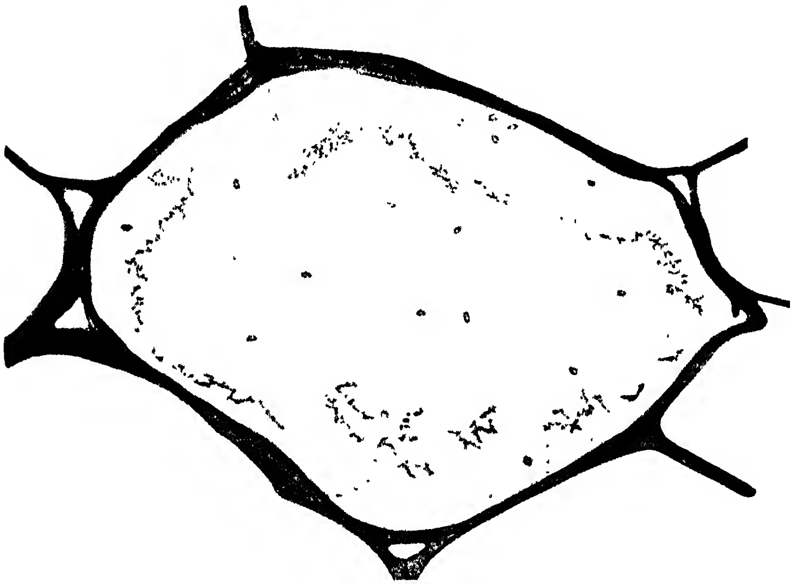

Fig. 81.—*Cell from a section of a turnip inoculated with bacteria from cultures prepared by the writer.* Greatly magnified.

access to the bulbs, on account of loss of leafage, might cause stay of bacterial growth and the destruction of bacteria. I would attach, however, more importance than the authors do to recuperative power and vigour that must attend the development of new leaves, and it seems beyond dispute that weather conditions play a part.

Professor Potter, in his communication to the Royal Society, gives a very thorough exposition of the methods by which he obtained his culture material, and of his successful inoculation experiments. In his experiments it was found that the disease could also be communicated to the potato and carrot, but not to beetroot.

Why attacked Bulbs break down.

The rot induced by the bacterium *Pseudomonas destructans* is the work of a cytase ferment the product of the bacterial activity. This ferment acts on the walls of the cells of the turnip, causing them to swell and to soften; the middle lamella (the central part of the common wall of cells) is dissolved, and so the cells fall apart and the whole tissue becomes disorganised — see fig. 82, which I owe to the courtesy of Professor Potter. Potter, and Laurent,[1] a worker in France,

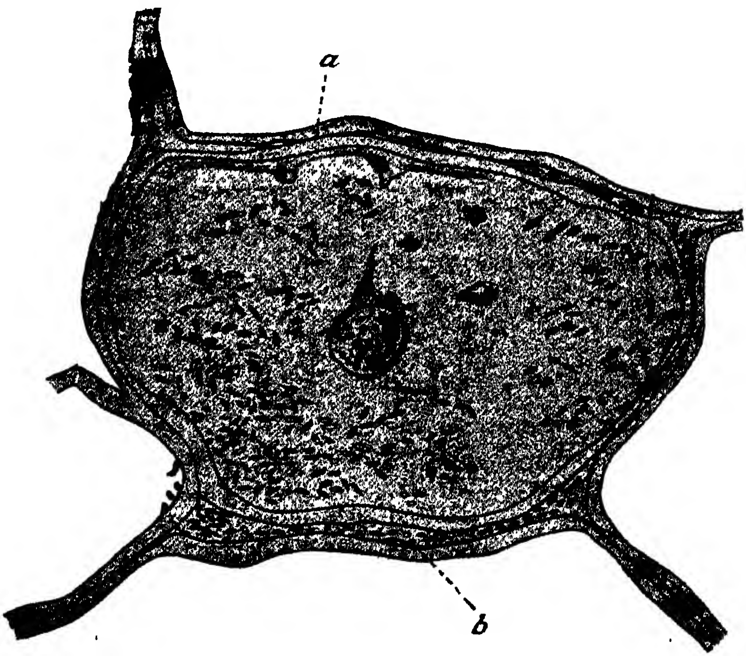

Fig. 82.—*A cell from a turnip inoculated with a pure culture of* P. destructans.

The bacteria are seen in the cell cavity and also along the track of the middle lamella, and in the intercellular spaces. The cell-wall is much swollen; at *a* it is just beginning to separate along the middle lamella, and at *b* the dissociation is more strongly marked. The nucleus and portions of the protoplasm still remain. (Potter.)

share the honour of isolating from bacteria a ferment which has the power of dissolving the middle lamella of living cells. In other cases of rot—*e.g.*, the wet rot of potato, ascribed, as I have pointed out, by some to bacteria—the opposing school argue that bacteria are not able to invade healthy tissue, that this must be dead or sickly, that the unhealthy condition is in

[1] "Recherches Expérimentales sur les Maladies des Plantes," by E. Laurent. 'Annales de l'Institut Pasteur,' vol. 1899.

the potato first produced by other agencies and that the bacteria follow as secondary agents. In view of this latter theory, the scientific importance of Laurent's and Potter's work is clear.

It is not disputed that apart from living cells bacteria may cause disintegration of cell walls—*e.g.*, the useful action of certain bacteria in decomposing cellulose (cell-walls are to a large extent cellulose) in its passage through the alimentary canal of grazing animals.

Ferments and their Work.

Ferments are sometimes written of as if there were two separate sets, unorganised ferments—*i e.*, lifeless organic substances secreted by the protoplasm—and organised ferments, where the display of chemical activity known as fermentation is regarded as taking place only in the presence of certain living organisms—*e.g.*, bacteria.

Now without going into the academic question of the suggested differences between unorganised and organised ferments, a few explanatory statements seem necessary for the elucidation of rot in turnips, about ferments, and in particular about the ferment cytase, which is said to be the cause of the breaking down of the turnip cells.

The Importance of Ferments in the Plant World for Digestion.

The important part played by ferments in intestinal and other juices of animals in digestion is well recognised, but it is only comparatively recently that an important *rôle* has been assigned to ferments in the vegetable world.

In the plant world stores of food material, laid up in various parts of the plant, are very common. If we take the seed as an excellent example of a place of storage, such stores being laid up for the use of the embryo plants, we find three typical kinds of store—viz., starch and cellulose, proteids, fat and oil.

Now in the condition in which these may be found in the seed the substances are insoluble and indiffusible—*i.e.*, they are unable to pass through the cell-walls, and so cannot be transported to where they can be made use of. One of the problems then in germination is that these reserves become converted into a soluble diffusible condition, and the problem is solved by the agency of ferments. What the ferment really is may not be quite certain, but at any rate "by their works ye shall know them," for a very little ferment is able to act upon relatively a very large amount of stored material. In passing, it may be noted too that those ferments are active only within certain ranges of temperature, and their action may be hindered by exposure to

light. One of these ferments is diastase, which in the case of, say, cereal grains (in cereals the ferments are secreted by a special layer of cells in the embryo) acts upon insoluble indiffusible starch and changes it into soluble diffusible sugar. This starch, however, is enclosed in cells, and in order that the diastase may reach the starch the cell-wall has to be broken down. This is done by cytase.

Cytase.

Our knowledge of cytase ferments [1] dates from 1886, when De Bary,[2] investigating a fungus, *Sclerotium sclerotiorum* (Massee), which attacks a large number of plants, including swede, turnip, potato, haricot beans, cucumbers, noticed that drops of fluid were secreted at the ends of the hyphæ or threads of the fungus; in these drops, what came to be called cytase was found. The exudation seemed to poison the cells of the attacked part, so that the fungus threads readily entered the cells and completed the destruction.

In 1888 Professor Marshall Ward [3] noticed the same in connection with a Botrytis fungus that was proving very destructive to lilies—*e.g.*, *Lilium auratum* and *Lilium candidum*. De Bary isolated the ferment by squeezing the juices out of attacked tissues; and fresh pieces of carrot or potato placed in this were gradually destroyed.

Potter has shown that one of the exciting causes of a rottenness which is found in swedes or turnips on being taken from the pit where they have been stored is a Botrytis, with similar action to the above.[4] In these cases, as now with *Pseudomonas destructans*, the cytase softens the cell-walls, slowly dissolving them, and makes special advance in the middle lamella, so that cell falls away from cell.

I have already referred to the action of a cytase in the germination of cereals and grasses, and our knowledge of this we owe to Brown [5] and Morris [6] and Escombe. Cytase seems to be destroyed at a temperature of 140° Fahr.

[1] The Soluble Ferments and Fermentation. By Prof. Reynolds Green (Cambridge Univ. Press).

[2] Ueber einige Sclerotinien und Sclerotien-Krankheiten. By De Bary. Bot. Zeit., 1866.

[3] "A Lily Disease," by Marshall Ward. 'Annals of Botany,' 1888.

[4] "Rottenness of Turnips and Swedes in Store," by M. C. Potter, M.A., F.L.S. 'Board of Agric. Journal,' September 1896.

[5] "On the Germination of some of the Gramineæ," by Brown and Morris. 'Journ. Chem. Soc. Trans.,' 1890.

[6] "On the Depletion of the Endosperm of *Hordeum vulgare* during Germination," by Brown and Escombe. 'Proc. Roy. Soc.,' vol. lxiii., 1898.

How the Bacteria enter the Turnip or Swede.

As to the method by which the bacterium gains entry to the bulb, it seems that a wound is necessary. In my experiments I have dressed the outside of a sound bulb with diseased material from a rotten turnip, and have also placed on the rind of the turnip and swede bacteria from my cultures, and have not succeeded in setting up the disease. The cytase ferment seems unable to act on walls that are corky, or where the cellulose of the wall has undergone a change into lignin (characteristic of the walls of wood-cells and other strengthening tissue), or into cutin—a change which takes place in the outside layers of the epidermal cells.

On the other hand, when placed on an exposed cut surface of the bulb—*i.e.*, brought into contact with the parenchyma—the bacteria gave the disease. The bearing of the fact that the surface must first be wounded, so that a place of entry is provided. will be made clear after we have dealt with insect attack on the turnip, and with the threefold part insects may play in being the cause of destruction by themselves, in being the forerunners of diseases that follow their woundings, and in being the actual spreaders of disease.

Insect Enemies of the Turnip and Swede.

In addition to the surface caterpillars described elsewhere in this same volume of 'Transactions,' the roots are subject to the attacks of the larvæ of various flies belonging to the family Anthomyiidæ—a family of flies which look somewhat like house-flies, and which are sometimes found on window-panes in houses. This family numbers amongst its members such troublesome pests to the farmer as the turnip and cabbage-root flies, the onion fly, the beet fly.

In the early autumn of 1900, during a visit to several farms in Dumfriesshire and Kirkcudbrightshire, while dissecting in the fields a number of leaf-stalks and bulbs of swede and turnip, I exposed in a fair number of cases dipterous larvæ. Again, this year, in specimens of bulbs received from Galashiels and from Fife, I met the same kind of grubs. In order to make certain of the species—for the maggots of the Anthomyiidæ, as indeed of other families of flies, are exceedingly like one another—I resolved, if possible, to breed the maggots up to the adult stage, for determination. Through the kindness of Mr William Bruce, B.Sc., and Mr David Black of Tullybreck, I obtained material in the shape of plants that were as sent to me described as "double-shawed." On dissection I had no difficulty in finding the grubs I was in search of.

Some of the plants received were not "rotted," but only grubs were found in them; others, including specimens collected by myself, harboured not only the grubs, but were at the same time a prey to *Pseudomonas destructans.*

The Maggots of a New Fly.

Description.—The larvæ, one of which is seen in fig. 83, are whitish yellow in colour and have two black curved hooks at the more pointed front end. Using a lens, these hooks can be traced backwards below the skin as connected with a dark supporting structure. At the hind end, looking down on the posterior surface of the last segment, there are two little brownish or dark plates, which are the plates on which

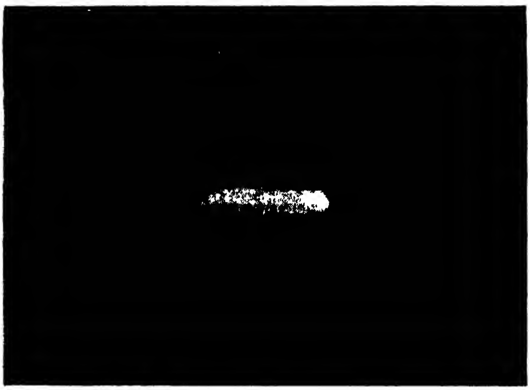

Fig. 83.—*Larva of new fly.* Magnified about twice.

breathing-pores open. Round the edge of this hind part are tiny tooth-like projections, most marked at the lower edge.

Where found.—The maggots are to be found both in the stalks of the shaws and in the bulbs, and there may be several of them in the same bulb. They gnaw galleries in the tissue, which galleries are easy to trace from the brown, discoloured, decayed-looking appearance marking the track of the larva. One of the maggots placed on a freshly-exposed surface of turnip soon buried itself. In many cases it was easy to trace the galleries to the outside. The place of entry, with the resulting tunnels, is not always at the apex of the bulb, but sometimes at the sides.

Pupa.—It is probable that when full-grown the maggot leaves the plant and becomes a pupa in the soil; some larvæ which I placed in soil in a jar soon buried themselves. I

arranged some maggots in pieces of turnip in jars covered with gauze, and these, after feeding for some time, became pupæ inside their last moulted skin, the "cocoons" being brown and round or barrel-shaped. These "cocoons" I covered with soil, and in due course obtained some flies.

I submitted my bred-out specimens to Mr Percy Grimshaw, F.E.S., one of our authorities on Diptera, who informed me that the fly did not agree in characters with any of our British Diptera. There being no British record of the fly, I sent my specimens to a Continental authority, Herr P. Stein, who replied that the fly was a new species. Later, however, in reply to a letter of mine asking him to suggest a name for the fly, Herr Stein wrote me to say that, after more careful consideration, he was not absolutely sure that the fly was new to science, as it had a certain resemblance to two other flies, neither of which, however, is British. Here the matter rests at present, but I hope this year with still further material to settle the matter.

The destructive work of this maggot in leaf-stalk and bulb occasions a "double-shawed" appearance, on account of the development of fresh leaves to replace the attacked ones, and the growth of the plant is hindered.

If it be regarded as proved that *Pseudomonas destructans* cannot enter to set up rot, unless in the presence of a previous wound, the work of this fly has an added importance.

In some of the attacked specimens of plants sent to me I found the caterpillars of *Agrotis segetum* at work, and others showed traces of their gnawing. Fig. 84 gives a very good idea of how the surface of the turnip can be so wounded that the entry of injurious bacteria and fungi is easy.

How to combat Turnip Rot.

General Principles.

1. The destruction of attacked plants, either on a small scale by fire, or in greater attack by thoroughly "composting" them to make sure of the destruction of the bacteria. The whole history of *Pseudomonas destructans* is not thoroughly known, and it is possible that the bacterium may be able to adopt for a time a saprophytic life. Many fungi, for example, act as parasites in presence of a live host, and yet have the power, in absence of a live host, of living for a time a saprophytic life—*i.e.*, nourishing themselves on dead, decaying organic matter. Now if there be the risk of this in connection with *Pseudomonas destructans*, it is clear that the soil occupied by such rotted plants as are left lying may become infected and act as centres

of infection when turnips or swedes are taken again. This suggests—

2. The wisdom of lengthening the rotation in cases where the attack of rot has been very bad. If the conditions of the farm would allow of it, the field might be laid down to grass for some time, so that before turnips or swedes were taken again the pest would have been starved out.

Fig. 84.—*Caterpillars of* Agrotis segetum *at work.* (After Newman.)

3. There is great risk of infection if by any chance there be present, mixed in manure, remains of such plants as had been infested with Pseudomonas. In our farm practice there is less likelihood of this taking place with Pseudomonas-attacked plants than with some other diseases; but still there is the chance of diseased plants being pulled up and thrown on the dung-heap.

4. The making of conditions as favourable for the crop as possible implies, amongst other things, the most strenuous effort against insects, not only as destroyers of plants but as carriers of disease. That bacterial and fungous diseases in the animal world—*e.g.*, cholera, ophthalmia, typhoid fever, ringworm, and the plague—are spread by insects is attested by experiment; and disease in the plant world is spread in the same way.

It is very interesting to find the plant pathologists in the United States holding that in the various rots due to bacteria, insects are the chief agents of the spread [1]—*e.g.*, in the bacterial diseases of pear-blight, cucumbers, potato, and cabbage, mentioned earlier in this report. In the case of pear-blight no other means of spread is known save spread by insect agency. As to rot of cucumbers, Dr Smith has experimented with the sticky

1 "The Spread of Plant Diseases," by Dr Erwin F. Smith, in the 'Transactions of the Massachusetts Horticultural Society,' Part I., 1898.

bacterium causing the disease, and finds that it is readily carried by "the striped cucumber beetle and by squash bugs." In addition to satisfying himself in hundreds of examined cases that the bacterial disease attacked the plants by way of insect punctures, Dr Smith was also successful in communicating the disease by allowing the striped beetles to feed first on diseased plants and then on healthy ones. He believes that insects are almost entirely the cause of the spread of this disease, as in 400 experimental inoculations, made while studying the disease, not once did the disease pass to the control plants of the various experiments. The same author found that the caterpillars of *Plusia brassicæ* acted as agents in the spread of the brown rot of cabbage.

In the potato rot the Colorado beetle very readily carries the disease from one plant to another.

All this, in view of the variety of insect life, may be sufficiently discouraging to the turnip and swede grower. But the time has long passed when, with us, "to tickle the earth with a plough is to make it smile with a harvest." It is recognised that nature is a state of war, that the farm is a battlefield where a legion of enemies contends with the cultivator, and in this warfare the farmer must take care that in a very active way his weight is thrown into the scale in favour of the crop and against its enemies.

In conclusion, I desire to express my thanks to my friend Dr Murray, and to Mr James Biggar, who, at my request, so promptly and willingly notified me of outbreaks of the disease in different farms in the south of Scotland.

TEST OF VARIOUS KINDS OF OATS.

By John Speir, Newton Farm, Glasgow.

In this experiment the cross-bred varieties of oats recently introduced by the Messrs Garton were compared with the older varieties in general cultivation in this district, as well as with two varieties which, on the average of ten years, have given very good results in the experimental trials carried out on the Government experimental farms of Canada. Besides comparing the producing power of each variety grown under similar conditions of field cultivation, I made an attempt to compare the

produce of several of the varieties from seed grown on the farm for one or more years with that brought from a distance. The gain from changing seed in 1900, which had been grown on the farm for only two seasons, turned out to be so much more than was anticipated that it was decided to again repeat this part of the test in 1901.

The following is a plan, not to scale, of the field and plots:—

Ordinary crop.

Ordinary crop.

Cheshire Tartar King.
Own Tartar King.
Improved Tartar King.
Garton's seed, Tartar King.
Hamilton, East Lothian seed
Hamilton, Local seed.
Potato, East Lothian seed.
Longhoughton, East Lothian seed.
Goldfinder, Garton's seed.
Goldfinder, own seed.
American Beauty, own seed.
Waverley, own seed.
Waverley, East Lothian seed.
Banner, own seed.
Banner, East Lothian seed.

Ordinary crop.

Ordinary crop.

Land.

The soil of all the plots was as uniform as it was almost possible to get any piece of land. Along the ends of the plots there was a dry strip, which seemed about equal in all the plots, and on this strip the crop became very thin during May. No trace of grubs, wireworms, or tulip-root could be found, yet half of the plants died on this part. This class of land was of larger area on the outside plot—that sown with Banner, East Lothian seed—than on the others, and it suffered more than these, consequently the results from it are not comparable with the results from the others, although recorded here.

I am unable to account for this defect in oats on the lightest land of this farm, which I have repeatedly noticed, and although I have sent samples of the plants on several occasions to specialists in plant diseases, none have been able to say what was wrong. The land was not of a class likely to produce a large quantity of grain of the best quality in any season, being too light for that purpose, but with the one exception noted, any defects it had applied alike to every plot.

The plots were so arranged that all the beginnings and finishes in ploughing were occupied by the paths between the plots, and, as in former years, the plots themselves were ¼-acre in area. In 1900 the land had carried two crops of hay, and in October had received about 12 tons of stable-manure per acre over all the plots, no artificial manures of any kind being used on any of them.

Seed.

The quantities of seed used per imperial acre may to many seem large, but none of the plots of the larger grained varieties were any too thick. All the plots which gave the highest yields were the thickest planted. As the seed used varied greatly in size of grain, each variety was sown at such a rate per acre as was calculated from previous experience would give a full plant (see 'Transactions' for 1900, p. 231). While the size of the kernel of any variety is an important element in fixing the amount of seed necessary for each acre, another equally important factor is its tillering power, and in seeding these plots both were taken into account. Sowing was done by the drill sowing-machine. The same number of breadths of the machine was devoted to each plot, a space of about 2 feet being left between the plots. These spaces were cleaned twice during the season with the Dutch hoe. In order to prevent damage by shelter or otherwise from the hedges or by birds, the plots were kept from 30 to 50 feet from the outside of the field, which contained 20 acres.

Period necessary for Ripening.

All the varieties were sown on 19th March, the weather being dry and the land in good condition. The earliest to ripen was Tartar King Improved, which was a couple of days or so earlier than the crops from Tartar King seed from Messrs Garton, or from Cheshire. The Tartar King Improved was obtained direct from Messrs Garton. It seems to have if anything a larger kernel than even Tartar King, but in other respects it does not appear to differ from it. The crop from seed which had been grown on the farm for three seasons was the latest to

ripen of this variety. All the plots of Tartar King were very uniform in thickness of crop and quality of land, so that the difference in ripening can only be accounted for by the source of the seed used.

The average period of ripening may be represented by the Potato variety. It will be noticed that the two plots of Hamilton and the one of Potato all ripened at the same time. At no period of their growth could any difference be found between any of these varieties other than what might be expected from a crop, the seed for which had been drawn from different sources. This and other tests I have made lead me to believe that these so-called varieties differ so little as scarcely to warrant the keeping of them separate, or the giving of them any name other than Potato.

Longhoughton in many respects is very similar to Potato, and unless in the weight of straw per acre I could see no difference between it and Potato at any period of their growth. With the exception of the Waverley seed from Messrs Garton, the remainder of the varieties tested all required somewhat longer to ripen than Potato.

In 1901 sowing was carried out about the usual date common on this farm—viz., the third week in March. In 1900 it did not take place till a fortnight later, yet notwithstanding the earliness of the season of 1901, the number of days between sowing and ripening was greater in 1901 than in 1900.

The following table shows the number of days required to ripen each variety grown during these two seasons:—

Variety.	1900.	1901.	Difference.
Tartar King, seed from Garton	133	139	6
Tartar King, own seed	...	140	...
Waverley, new seed	144	150	6
Waverley, own seed	144	158	14
American Beauty, own seed	144	158	14
Hamilton, local seed	144	150	6
Goldfinder, new seed	135	154	19
Banner, new seed	142	158	16

Within reasonable limits it is always desirable in most districts of Scotland to get grain to ripen as early as possible. That, however, is probably only a gain when not carried to extremes, as the large grain crops of Scotland are perhaps to a considerable extent accounted for by the long growing period compared with that in many other countries. As has often been noticed, the crops from changed seed, with the exception of Banner, all ripened several days earlier than where the seed used had previously been grown on the farm. This point is worthy of notice by those farming in late districts, or where seeding has been unduly delayed.

TABLE SHOWING THE PRODUCE OF EACH VARIETY OF OAT FOR SEASON 1901.

Variety.	Source of seed used.	Seed in bushel per acre.	Bushels of 40 lb. per acre: Dressed.	Bushels of 40 lb. per acre: Light	Total bushels per acre.	Lb. per bushel.	Per cent of grain to straw.	Straw and chaff per acre. (tons cwt. lb.)	Per cent of straw to grain.	Days to mature.
Tartar King	Cheshire	$4\frac{1}{2}$	$65\frac{20}{40}$	$1\frac{24}{40}$	$67\frac{4}{40}$	43	...	*	...	139
"	Newton	5	$50\frac{16}{40}$	$1\frac{24}{40}$	52	43	...	*	...	140
" Improved . .	Garton	5	$67\frac{8}{40}$	$1\frac{4}{40}$	$68\frac{12}{40}$	41	...	*	...	137
"	"	$4\frac{1}{2}$	$58\frac{8}{40}$	$1\frac{18}{40}$	$59\frac{20}{40}$	44	...	*	...	139
Hamilton	East Lothian	4	$56\frac{36}{40}$	$2\frac{32}{40}$	$59\frac{30}{40}$	$43\frac{1}{2}$	31·2	2 7 14	68·8	150
"	Local	$4\frac{1}{2}$	$58\frac{28}{40}$	$2\frac{12}{40}$	61	$44\frac{1}{2}$	30·5	2 9 70	69·5	150
Potato	East Lothian	4	$50\frac{28}{40}$	$2\frac{9}{40}$	$52\frac{28}{40}$	44	29·9	2 4 14	70·1	150
Longhoughton . . .	"	4	$56\frac{32}{40}$	$1\frac{4}{40}$	$57\frac{36}{40}$	44	34·2	1 19 84	65·8	150
Goldfinder	Garton	$4\frac{1}{2}$	$78\frac{28}{40}$	$3\frac{20}{40}$	$82\frac{8}{40}$	42	42·1	2 0 14	57·9	154
"	Newton	5	$63\frac{28}{40}$	$2\frac{20}{40}$	$66\frac{8}{40}$	$41\frac{1}{2}$	37·8	1 18 98	62·2	158
American Beauty . . .	"	5	$54\frac{16}{40}$	$3\frac{0}{40}$	$57\frac{16}{40}$	42	34·5	1 19 0	65·5	158
Waverley	"	5	$63\frac{28}{40}$	$2\frac{36}{40}$	$66\frac{24}{40}$	43	36·8	2 0 84	63·2	158
"	East Lothian	$4\frac{1}{2}$	$74\frac{16}{40}$	$2\frac{24}{40}$	77	$43\frac{1}{2}$	43·5	1 15 56	56·5	150
Banner	Newton	5	$65\frac{16}{40}$	$2\frac{16}{40}$	$67\frac{32}{40}$	43	39·1	1 17 84	60·9	158
"	East Lothian	$4\frac{1}{2}$	$53\frac{28}{40}$	$2\frac{24}{40}$	$56\frac{12}{40}$	43	35·5	1 16 56	64·5	158

* In this case the straw was omitted to be weighed.

All the plots this year were threshed from the stook, the weather being dry and settled. The plots of Tartar King were threshed at one time a few days before the others, which were all threshed on the same day. Unfortunately it was omitted to weigh the sheaves of the Tartar King plots, therefore the weight of straw and chaff cannot be given. In the other cases the weight of straw and chaff was estimated by first weighing the sheaves as they came from the field, deducting the total weight of grain from that of the sheaves, and estimating the difference as straw and chaff. Little of the straw of any of the varieties was lodged this year, although all of it was a moderate length. During the process of threshing, small samples of the straw were drawn during the whole time, so that the samples are representative of the whole plot, and not of a few sheaves only. These were sent to Dr A. P. Aitken for analysis, and will be reported on by him.

The proportion of Grain to Straw.

As would naturally be expected in a dry season like that of 1901, the proportion of grain to straw is much higher than in 1900. Owing to the straw of Tartar King not having been weighed, it can only be estimated; but judging from its length compared with that of Goldfinder, Tartar King should not be less than 40 per cent of grain. On this basis the average of all the varieties for 1901 is 37 per cent of grain to 63 per cent of straw and chaff. In 1900 the average of ten plots was 30·6 per cent of grain to 69·4 per cent of straw. This gain of 6·4 per cent in favour of the grain of 1901 is of course largely the result of the season, which for this land was favourable not only for the production of a full crop of grain of good quality, but also for a full crop of straw.

The Advantage of a Change of Seed.

The value of a change of seed is very differently estimated by experienced farmers all over the country. Many consider that a change of seed is only necessary at intervals of a considerable number of years. Others think they have the best return from new seed the second year, while very few consider it desirable to change all their seed. Taking the average of all the varieties where seed grown on the farm and new seed were sown, but excluding local seed, which may be considered neither new nor unchanged, it will be found that the produce of the changed seed shows a gain of 5¼ bushels per acre over the other. One of these plots—viz., Banner from new seed—is, however, not

comparable with the others, therefore Banner from both old and new seed should be deleted. If such is done we get the following results:-

	Changed seed. Total produce in bushels.	Home seed. Total produce in bushels.	Gain in bushels.
Tartar King, average of 3 plots	$64\frac{39}{40}$	52	$12\frac{39}{40}$
Goldfinder . . .	$82\frac{8}{40}$	$66\frac{8}{40}$	$16\frac{8}{40}$
Waverley . . .	77	$66\frac{24}{40}$	$10\frac{16}{40}$
Average gain . . .			$13\frac{5}{40}$

In 1900 the average gain from changing seed was $9\frac{29}{40}$ bushels per acre; in 1901 it is $13\frac{5}{40}$ bushels, giving an average for two years of $11\frac{17}{40}$ bushels per acre. The gain from changing the seed in 1900 was greater than I had anticipated, but in 1901 it is greater still, yet these oats had only been previously grown three years on the farm.

Whatever was the cause of the plants dying on the narrow strip of dry land along the ends of the plots, it was, with the exception of the Banner from new seed, much less where fresh seed was used than where home-grown seed was sown. This or a similar effect I have often noticed on land affected with leather-jacket grub.

The following table gives the average produce, greatest and least yield, for several varieties of oats tested here during the past four years :—

Variety.	Average of 4 years in bushels.	Average of 3 years in bushels.	Average of 2 years in bushels.	Greatest yield in bushels.	Least yield in bushels
Waverley . .	$69\frac{23}{40}$	...	...	$101\frac{8}{40}$	$46\frac{13}{40}$
Tartar King . .	$65\frac{20}{40}$	...	...	$94\frac{18}{40}$	$41\frac{14}{40}$
Potato . . .	$51\frac{14}{40}$	...	...	$63\frac{5}{40}$	$40\frac{14}{40}$
Goldfinder . .	...	$59\frac{28}{40}$	...	$82\frac{8}{40}$	$49\frac{20}{40}$
American Beauty .	...	$55\frac{15}{40}$	...	$58\frac{8}{40}$	$46\frac{12}{40}$
Pioneer . .	...	...	$62\frac{16}{40}$	$87\frac{15}{40}$	$37\frac{18}{40}$
Abundance . .	...	...	62	$68\frac{9}{40}$	$43\frac{32}{40}$
Banner . .	...	...	...	$67\frac{33}{40}$	...

An examination of the ears of the different varieties showed, as in former years, that the gain in grain by the cross-bred varieties over the older introduced kinds was not made up by

an increased size of ear, but by an increase in the number of grains in each spikelet. In the older varieties few of the spikelets contained two full-sized kernels, the majority having one full-sized one and a smaller one. With the new cross-bred varieties nearly every spikelet contained at least two full-sized grains, often two full-sized ones and one small one; and occasionally, on Goldfinder especially, spikelets were found containing four grains.

In previous years it was noticed that many of the spikelets of the Potato oat seemed not to be fertilised in the flower stage, as a little later on they became white and never contained any kernels. This result was rarely seen in the cross-bred varieties in any previous season, but this year a considerable number were found in the new varieties, while a less number than usual were found on Hamilton and Potato, but still more than on the others.

All the details of measuring the land, superintending the seeding, harvesting, threshing, and dressing were done under my own supervision.

Damage by Mice.

Since the foregoing was written a curious fact has come to light regarding Tartar King and Goldfinder oats. As the area of oats in 1901 was less than usual on this farm, and as, owing to the number of stock kept, the whole of the straw of the oat crop is generally required for fodder, it was decided to keep over three stacks of Tartar King and two of Goldfinder oats from the crop of 1900. Both lots of stacks were standing together, the Tartar King in one row at the outside of the stackyard, and the Goldfinder in another in front of those of Tartar King, each stack being about 6 feet from its neighbour. Early in autumn the stacks of Goldfinder showed unmistakable signs of being infested with mice. Both lots of stacks were threshed early in December, when it was found that serious damage had been done to the stacks of Goldfinder oats, while only trifling damage had been done to those of Tartar King.

Stacks of Waverley of crop 1901 are alongside those of crop 1900, but as yet there is no appearance of any unusual number of mice being in them.

Both stacks of Goldfinder oats contained mice in hundreds, if not thousands, while the neighbouring stacks of Tartar King of the same age only contained a very few. In some way or other the Goldfinder oats were either favourable to the breeding of the mice, or those of Tartar King were unfavourable, or the one was very much more relished by the mice than the other. I incline to the belief that the last suggestion is the correct one.

Similar facts are often noticed where oats and wheat are stacked close to each other, and rats are present in greater or less number. Under these circumstances the rats will congregate principally in the wheat-stacks, and as long as they stand will confine themselves to them and only migrate to the oat-stacks after the wheat ones have been removed. Much the same seems to have happened with the mice, which seem to have found the Goldfinder oats much more to their taste than the other varieties. I do not know what the tastes of mice are in this respect, but it may ultimately be found that Goldfinder oats are more palatable, say, as in porridge or in cakes, than other varieties. I have not yet had any Goldfinder oats made into meal, and have not subjected them to the above test.

ANALYSIS OF VARIETIES OF OATS GROWN BY MR SPEIR AT NEWTON FARM IN 1901.

By Dr A. P. Aitken, Chemist to the Society.

In the volume of the 'Transactions' for 1901 (5th ser., vol. xiii. pp. 276-284) a report is given by Mr Speir on the growth and characteristics of old and new varieties of oats; and appended thereto is a report (pp. 284-295) of the analysis of the straw and grain of the ten varieties included in the experiment. The results of the analysis, as well as those of the crops themselves, showed such well-marked and important differences that it seemed desirable that the experiment should be continued, so as to show whether the differences observed were of a constant character inherent in the nature of the varieties tested, and especially to determine whether the differences found in the same variety when raised from newly imported seed, and from that grown on the farm during the previous season, were also permanent.

The field chosen for the present experiment was a piece of very equal land, and the fifteen plots on which the varieties were grown were so situated and circumstanced as to eliminate as far as possible the irregularities due to accidental soil differences.

The straws and grains of the crops grown on these plots have been analysed, and the results are given in tabulated form, pp. 280-283.

The Seasons of 1900 *and* 1901.

Before proceeding to compare the results of analysis, and a further comparison of these results with those of the former

season, a few words regarding the general conditions under which the two crops were grown will be found useful.

The seasons of 1900 and 1901 were very different. In 1900 the rainfall was much above average, but a fine dry March enabled sowing to be carried out under the best conditions when the seed was put in at the beginning of April. The crop brairded quickly, and made rapid growth in its comparative youth. The summer was of average dulness and of average temperature; but as a good deal of rain fell in the latter part of the season, there was produced on some of the plots an after-growth of straw which did not ripen.

In 1901 matters were entirely different; the rainfall was much below average, causing on light lands a scarcity of straw, and the summer was exceptionally warm and sunny. Sowing was carried out a fortnight earlier than in the preceding year; but owing to the drought it was long before the braird appeared. Thus it will be seen that the two seasons were almost in complete contrast.

It is therefore not surprising to find that, despite the hot dry summer of 1901, the oat crop in districts where the soil was fairly deep made up for its belated brairding and retarded growth during its youth by a prolonged growth during its later stages, producing eventually a full crop late of ripening. It seems highly probable also that full growth was achieved at the cost of a much larger proportion of root-growth than would otherwise have occurred, and that the subsoil would be more than usually called upon to provide the mineral matter required for the plant's development. One marked character of the composition of the oat-straw grown in 1901 is the small amount of ash, showing with what difficulty the necessary amount of mineral matter had been collected. But the fine, dry, warm weather of July and August enabled the plants to mature well, and make exceptionally good use of the nutritive material elaborated in the leaf and stem of the straw. For it must be remembered that the whole effort of plant-life is directed towards the nourishment of the embryo and the accumulation of nutritive vegetable matter in the seed for that purpose. It is in the leaf that the starch, albumen, and oil are made; during ripening they pass upwards to the seed, and as the seed becomes richer in these constituents the straw becomes poorer, so that in seasons favourable to ripening the nutritive matter will have mostly left the straw and be found stored up in the grain.

The Quantity of Crops in 1900 *and* 1901.

Before comparing the quality of the crops of 1900 and 1901 it will be instructive to compare the average quantities pro-

duced in the two seasons that differed so widely in their character.

Average Quantity of all the Varieties in 1900 and 1901.

	1900.	1901.
Dressed grain (at 40 lb. per bushel) . .	55 bushels per acre	61 bushels per acre.
Light grain (at 40 lb. per bushel) . . .	3 "	2·2 "
Total bushels per acre .	58 "	64 "
Weight per bushel . .	39 lb.	43 lb.
Straw and chaff per acre .	43 cwt.	42 cwt.
Percentage of grain . .	32 per cent	36 per cent
" straw . .	68 "	64 "

These figures show at a glance the difference between the two seasons. The long, dry, sunny summer of 1901 was in every respect favourable, not only to the quantity of the grain, but also to its quality, in so far as that is related to the weight per bushel. There is a slight deficiency in the quantity of straw; but owing to the moisture contained in the subsoil, it is not so much as the great difference in rainfall and temperature would have led one to expect. Mr Speir reports that, despite the hot dry summer, the average length of the period between sowing and reaping was ten days longer than in the previous year.

Analyses of the Straws.

To this prolonged period of growth is due the unexpected amount of straw, and to this is also due what seems to me the most remarkable thing in the whole experiment—namely, the curious circumstance that the average composition of the straw of the two seasons is almost identical.

Average Composition of Straws of 1900 and 1901.

	1900.	1901.
Albumen	2·4	2·5
Amides, &c.	·8	·6
Crude protein . . .	3·2	3·1
Oil, &c. (ether extract) .	3·2	3·2
Carbohydrates, &c. . .	53·0	54·8
Woody fibre . . .	33·6	32·6
Ash	7·0	6·3
	100·0	100·0

Despite these closely agreeing averages, it will be seen, on comparing the results of the analyses of straw on Table I., p. 280, that the different varieties vary a good deal and deserve some comment.

The *Tartar King* has on this occasion taken the first place. Evidently the character of the season has given it an advantage over its competitors that it did not possess last year. It has not the coarse rank habit which distinguished it last year, and the analyses show it to be richest in crude protein, containing a high proportion of albumen. Of the four samples of *Tartar King*, the one which is most deficient in albumen is the "improved" variety. The effort at improvement, so far as quality is concerned and apart from the increased productiveness, has succeeded only in so far as it has diminished the amount of ash, and I presume it is owing to the less amount of silica in the ash that the improved sample feels softer than the other three—a quality that may make it more acceptable as a fodder. Upon the whole, there is evidence that the *Tartar King* has produced a strong straw of good quality; and a reference to Table II., p. 281, will show that the richness of the straw has not been obtained at the expense of the quality of the grain, for the grain also is above average in protein. Unfortunately the quantity per acre of the *Tartar King* crop of straw was not ascertained; but judging from appearances, and from the large amount of straw yielded in last year's experiment, it seems probable that, of all the varieties tried, it has produced the greatest amount of food per acre.

Hamilton oat-straw, which was superior to all the others in the former trial, owed its superiority to its greater tillering propensity, whereby a second growth of weak immature straw that never seeded gave it a fictitious advantage. During the dry summer of 1901, with its phenomenally hot July, the conditions required for tillering were in great measure awanting. There was no sudden check to growth early in the season, nor undue moisture at a later period, and it does not seem as if any of the samples had tillered to any considerable extent. Nevertheless the *Hamilton* is again a straw of excellent quality, and, moreover, it exceeds all the others in quantity, excepting perhaps the *Tartar King* Of the two samples of *Hamilton* the home-grown one was the softer, and resembled in this as in other respects the *Potato* oat-straw. *Longhoughton* was a coarse hard straw of large calibre, but well ripened. *Goldfinder* was a straw of average character, and, upon the whole, that grown from home seed was softer and of better quality. *American Beauty* was rather coarse, reddish in colour, and more brittle than the other samples. *Waverley* straw was somewhat below average in protein, but uncommonly well ripened and rich in carbohydrates. The home-grown seed produced a richer and softer straw. *Banner* straw was very similar to *Waverley* in quality. It was lighter in colour than any of the others, and the straw from the home-grown seed was rather better than that introduced from

East Lothian. Of the straws whose weights were ascertained the *Hamilton* was most productive, owing probably to its tillering habit, and was also of very good quality, though not excelling all the others, as it did the previous year. *Tartar King, Hamilton, Goldfinder*, and *Waverley* have all produced straw of high quality, and the home-grown seed has surpassed that which was introduced both in quantity and quality, except that in the case of *Goldfinder* the quantity was slightly greater from the changed seed.

Mr Speir in his report has shown that the introduced seed was most productive as regards grain, but the same cannot be said for the straw.

Analyses of the Grain.

The composition of the entire oats is shown in Table II., p. 281. As compared with the oats of the former season, their chief differences are such as result from more complete ripening. The average results of the two years were as follows:—

	1900.	1901.
Albumen	12·5	11·4
Amides, &c. . . .	1·1	·9
Crude protein . .	13·6	12·3
Oil	6·5	6·6
Carbohydrates, &c. . .	66·9	70·8
Woody fibre . . .	10·0	7·8
Ash	3·0	2·5
	100·0	100·0

The most notable difference in the quality of the two seasons is in the carbohydrates, which in oats consists almost entirely of starch. The greater amount of sunshine and the prolonged period of growth have favoured the production of starch, and the increase in this constituent has been got mostly at the expense of the woody fibre. The woody fibre of oats is chiefly resident in the husk, and it will be seen on Table III., p. 282, that in these samples it averaged 25 per cent, while in the husks of the former crop it averaged 31 per cent. In the kernels also there is a notable decrease of woody fibre—viz., 2 per cent, as against 3 per cent in the former year.

There is in the grain, just as there is in the straw, a diminution in the proportion of ash. With so high a percentage of carbohydrates the proportion of proteids is of course lowered. All these are the results of season affecting all the varieties equally.

Among the individual samples there are no very striking differences. The samples of Tartar King are above average in

the proportion of protein, as in the case of the straw, and they are also decidedly above average in the proportion of woody fibre, even to a greater extent than in the case of the straw, in this respect confirming the results of last year's crop, and this may perhaps be regarded as a peculiarity of that variety of grain. The differences between *Hamilton*, *Potato*, and *Longhoughton* oats, are not such as to call for special remark, and that lends support to Mr Speir's view that these three varieties are very much the same. *Goldfinder* oats, from both the home and imported seed, have almost an exactly similar composition, and they differ from all the others in the very high percentage of carbohydrates and deficiency of oil. Next to *Goldfinder* in respect of carbohydrates come *Banner* and *Waverley*, both home seed and imported. As in the case of the straws, so with the grain, there is no marked differences in composition of a constant kind between the new supplies of seed and those which have been grown on the farm; but it is probable that the exceptional character of the season has tended to obliterate distinctions due to that circumstance.

Analyses of the Husks.

The proportion of husk to kernel in the oats of 1901 is almost the same as in the former year. The *Tartar King* is distinguished by having the largest proportion of husk to kernel, and the recently improved variety has the largest proportion of all the varieties grown—practically 30 per cent of husk to 70 of kernel. *Goldfinder* has the smallest proportion of all—viz., $21\frac{1}{2}$ of husk to $78\frac{1}{2}$ of kernel in the case of the seed raised at Newton; but as the proportion is nearly 24 per cent in the imported seed, there is no evidence that lightness of husk is a characteristic of that variety of oat. The general character of the husks of the grain of 1901 differs from that of the former year in the same way as in the case of the straws—namely, an increase of the carbohydrates at the expense of the woody fibre, and a reduction in the proportion of protein; but a greater proportion of the latter constituent was true albumen, and the chaff of 1901 would on that account excel that of the former year in feeding quality.

Analyses of the Kernels.

Despite the prolonged period of growth and the fine sunny weather of 1901, it is doubtful if the oatmeal of that year is as good in feeding quality as that of its predecessor. The chief difference between the kernels of the two years is a diminution in the proportion of albumen, which in 1900 was nearly 16 per

cent, while in 1901 it only averaged 14½ per cent. Against this loss must be put an increase from 69 to 72 per cent of carbohydrates; but that can scarcely be regarded as sufficient compensation for a reduction of 1½ per cent of true albumen. Judged by ordinary chemical feeding standards, the oatmeal of 1901 would not be regarded as of so high a quality as that of 1900. The large proportion of albumen in the kernels of the corn raised from the *Tartar King* seed grown at Newton is the outstanding result; but all the *Tartar King* kernels are relatively rich in albumen, and so are those of the *Hamilton* oat. *Potato*, *Longhoughton*, and *American Beauty* take a second place, and the others are all pretty equally deficient in that constituent. *Goldfinder* is distinguished from all the rest by its low percentage of oil, a rather unfortunate characteristic.

Permanence of Results doubtful.

The main object of Mr Speir's experiments on the different varieties of oats is to discover in what respect the new or "improved" seeds now offered to farmers are superior to the well-known Potato oat—in the first place, as regards productiveness in grain and straw; and secondly, in respect of quality, as indicated by the weight per bushel of the grain and the strength of the straw. Other qualities—such as size, shape, and colour of the grain, and the length, colour, and attractiveness of the straw—have also received attention. In the present paper the relative merits of home-grown and imported seed take a prominent place. It was hoped that an analysis of the straw and grain of these varieties would yield additional information of a valuable kind as regards the feeding quality of the produce. The results, as referred to above, and as shown in the tables, do yield some positive information; but on comparing the analyses of one year's crop with that of the former year, or of the former two years where they are comparable, we see that they are subject to fluctuations so considerable as to demand great caution in drawing general conclusions.

The same may be said even more forcibly in respect of the quantity of crop per acre, for these have fluctuated enormously. It is quite evident that an experiment of this kind would require to be repeated several years in succession, and on precisely similar lines, in order to produce perfectly reliable information. Moreover, it is an experiment which to be of more than local value would require to be carried out under various conditions of soil and climate.

Total Value of Crops.

In appraising the relative values of the different varieties of oats on the basis of their analysis, preference will be given to one or other variety, according to the object the buyer has in view. If the oats are desired for horse-feeding, they will take rank according to their richness in protein, and especially in albumen, and also according to their richness in oil. The miller would probably attach most importance to the quantity of carbohydrates, in so far as mere analysis would serve as a guide; while the distiller would consider carbohydrates alone. The farmer who intends to consume his oat crop on his farm will wish to know which variety of seed will produce the largest amount of food per acre both in grain and straw.

Fodder Value of Crops.

To arrive at a fairly reliable estimate of the fodder value of a crop is not an easy matter where so many items have to be considered; but as that is a kind of valuation that will be of interest to many, I have calculated the quantities per acre of the protein, oil, and carbohydrates produced by the different varieties, and they are given on the subjoined table. The table might have been extended to include the woody fibre, but as that is not a very variable constituent, and one that is not usually reckoned in appraising concentrated fodders, it is unnecessary. Its inclusion would not appreciably affect the relative position of the various oats as fodders, and might seem to pretend to a greater amount of precision than these rough approximations possess.

Entire Oats. Constituents in Pounds per Acre.

	Protein.	Oil.	Carbohydrates.
1. Tartar King, Cheshire . .	338	180	1865
2. " Newton . .	266	148	1437
3. " improved . .	339	194	1893
4. " Garton . .	307	164	1659
5. Hamilton, East Lothian .	339	172	1630
6. " local . . .	305	161	1725
7. Potato, East Lothian .	249	171	1467
8. Longhoughton, " .	296	192	1600
9. Goldfinder, Garton . .	362	191	2410
10. " Newton . .	304	146	1949
11. American Beauty . .	292	172	1591
12. Waverley, Newton . .	314	178	1917
13. " East Lothian .	357	194	2224
14. Banner " .	307	158	1934

The relative feeding values of protein, oil, and carbohydrates in fodders are variable, according to the kind of fodder, and

their relative commercial values are subject to the fluctuations of the market.

Relative Values in Commercial Fodder Units.

It is the practice at present, when valuing linseed-cakes, to regard the protein and the oil each as three times as valuable as the carbohydrates. Whether that fairly represents their value in oats is open to question; but if we assume that the protein and oil in oats are each three times the value of the carbohydrates, we are able, by multiplying the quantities of protein and oil by 3, and adding the products so found to the quantity of carbohydrates, to arrive at total numbers, which in a rough estimate like this will fairly well indicate the relative value per acre of the varieties according to the experiment of 1901. They are arranged in their order of merit in the subjoined table:—

	Units.		Units.
1. Goldfinder, Garton . .	4069	8. Hamilton, East Lothian	3163
2. Waverley, East Lothian .	3877	9. " local . .	3123
3. Tartar King, improved .	3492	10. Tartar King, Garton .	3072
4. " Cheshire .	3419	11. Longhoughton . .	3064
5. Waverley, Newton . .	3413	12. American Beauty . .	2983
6. Banner, East Lothian .	3329	13. Potato, East Lothian .	2727
7. Goldfinder, Newton. .	3299	14. Tartar King, Newton .	2679

The main factor influencing the relative position of the varieties of oats in this list is of course the *quantity* of grain produced on the various quarter-acre plots; but these quantities have fluctuated enormously in former experiments, as may be seen on comparing the last two columns on the table given in Mr Speir's report, p. 269, so that there is no security that the variety tnat has produced the largest returns this year will do the same in the next year, and therefore the table of fodder units given above is only of transient interest; but a systematic pursuit of such an experiment would doubtless produce reliable results of permanent value.

A similar calculation applied to the straws of these varieties shows the following order of merit:—

	Units.		Units.
1. Hamilton, East Lothian .	4075	7. Banner, Newton . .	3282
2. " local . .	4012	8. Longhoughton . .	3200
3. Waverley, Newton . .	3709	9. Banner, East Lothian .	3143
4. Potato, East Lothian .	3488	10. Waverley, East Lothian	3037
5. Goldfinder, Garton . .	3403	11. American Beauty . .	3003
6. " Newton. .	3312		

The four samples of straws of Tartar King could not be included in this table, as the quantities grown per acre were not ascertained.

TABLE I.—ANALYSES OF OAT STRAWS (dried at 212° F.)

	Crude protein.	Albumen.	Amides = albumen.	Oil, &c.	Carbo-hydrates.	Woody fibre.	Ash.	Moisture in undried sample.
1. Tartar King, Cheshire	3·9	3·1	·8	3·0	51·3	34·5	7·3	14·7
2. " Newton	3·1	2·9	·2	2·5	54·7	29·9	9·8	14·4
3. " improved Garton	3·1	2·2	·9	3·0	52·5	35·7	5·7	14·7
4. " Garton	3·5	3·1	·4	3·2	51·0	35·0	7·3	14·3
5. Hamilton, East Lothian	3·1	2·6	·5	2·1	55·9	32·8	6·1	14·8
6. " local	3·1	2·2	·9	3·6	52·1	35·3	5·9	14·7
7. Potato, East Lothian	2·8	2·2	·6	3·5	51·7	35·3	6·7	14·4
8. Longhoughton, East Lothian	2·8	2·6	·2	3·3	54·6	32·7	6·6	14·6
9. Goldfinder, Garton	2·6	2·2	·4	3·4	57·7	30·2	6·1	14·4
10. " Newton	3·1	2·2	·9	3·8	55·4	31·6	6·1	14·6
11. American Beauty, Newton	2·6	2·4	·2	3·6	50·2	37·7	5·9	14·8
12. Waverley, Newton	2·8	2·4	·4	3·1	59·2	29·3	5·6	14·4
13. " East Lothian	2·6	2·6	[illegible]	3·7	57·6	31·0	5·1	14·8
14. Banner, Newton	2·8	2·6	·2	3·4	56·9	31·2	5·7	14·3
15. " East Lothian	2·4	1·7	·7	3·4	59·5	27·7	6·5	14·2
Approximate average	3·1	2·5	·6	3·2	54·8	32·6	6·3	14·5

TABLE II.—ANALYSES OF ENTIRE OATS (dried at 212° F.)

	Crude protein.	Albumen.	Amides = albumen.	Oil, &c.	Carbo-hydrates.	Woody fibre.	Ash.	Moisture in undried sample.
1. Tartar King, Cheshire	12·6	11·5	1·1	6·7	69·5	8·7	2·5	13·4
2. " Newton	12·8	12·1	·7	7·1	69·1	8·6	2·4	13·6
3. " improved Garton	12·4	11·1	1·3	7·1	69·3	8·8	2·4	13·4
4. " Garton	12·9	11·6	1·3	6·9	69·7	8·2	2·3	13·8
5. Hamilton, East Lothian	14·2	12·5	1·7	7·2	68·2	7·9	2·5	13·2
6. " local	12·5	11·8	·7	6·6	70·7	7·8	2·4	12·5
7. Potato, East Lothian	11·8	11·2	·6	8·1	69·6	8·3	2·2	12·8
8. Longhoughton, East Lothian	12·8	11·8	1·0	8·3	69·1	7·8	2·0	10·6
9. Goldfinder, Garton	11 0	10·7	·3	5·8	73·3	7·5	2·4	12·8
10. " Newton	11·5	10·8	·7	5·5	73·6	6·8	2·6	14·4
11. American Beauty, Newton	12·7	11·7	1·0	7·5	69·3	7·7	2·8	14·3
12. Waverley, Newton	11·8	11·0	·8	6·7	71·9	6·9	2·7	12·4
13. " East Lothian	11·6	10·4	1·2	6·3	72·2	7·2	2·7	12·4
14. Banner, East Lothian	11·5	10·9	·6	5·9	72·4	7·4	2·8	13·2
Approximate average	12·3	11·4	·9	6·6	70·8	7·8	2·5	13·0

TABLE III.—ANALYSES OF HUSKS OF OATS (dried at 212° F.)

	Crude protein.	Albumen	Amides= albumen.	Oil, &c.	Carbo-hydrates.	Woody fibre.	Ash.	Proportion of husk to kernel.
1. Tartar King, Cheshire	2·2	1·5	·7	2·9	64·4	26·6	3·9	27·5
2. " Newton	2·2	2·0	·2	3·6	65·0	25·8	3·4	28·5
3. " improved Garton	2·2	1·5	·7	3·5	65·0	26·3	3·0	30·2
4. " Garton	2·6	2·0	·6	3·9	64·8	25·4	3·3	27·7
5. Hamilton, East Lothian	3·0	2·6	·4	1·6	67·2	24·7	3·5	24·9
6. " local	2·2	1·3	·9	1·2	66·7	26·5	3·4	23·6
7. Potato, East Lothian	2·6	2·0	·6	1·8	64·7	27·8	3·1	22·9
8. Longhoughton, East Lothian	2·6	2·2	·4	2·9	65·4	25·5	3·6	23·3
9. Goldfinder, Garton	2·2	1·5	·7	3·9	62·7	26·1	5·1	23·8
10. " Newton	2·6	2·4	·2	2·9	66·9	22·6	5·0	21·5
11. American Beauty, Newton	3·0	2·8	·2	3·9	64·9	23·3	4·9	27·1
12. Waverley, Newton	3·0	2·6	·4	2·1	67·6	22·6	4·7	23·6
13. " East Lothian	2·2	1·5	·7	2·0	66·5	24·3	5·0	23·3
14. Banner, East Lothian	2·6	2·2	·4	2·4	67·0	23·3	4·7	24·5
Approximate average	2·5	2·0	5	2·7	65·7	25·0	4·0	24·5

TABLE IV.—Analyses of Kernels of Oats (dried at 212° F.)

	Crude protein.	Albumen.	Amides = albumen	Oil, &c.	Carbo-hydrates	Woody fibre.	Ash.	Proportion of kernel to husk.
1. Tartar King, Cheshire	16·6	15·3	1·3	8·2	71·3	1·9	2·0	72·5
2. " Newton	17·1	16·2	·9	8·4	70·7	1·8	2·0	71·5
3. " improved Garton	16·8	15·3	1·5	8·6	71·4	1·1	2·1	69·8
4. " Garton	16·8	15·3	1·5	8·0	71·7	1·6	1·9	72·3
5. Hamilton, East Lothian	16·6	15·7	·9	9·1	69·8	2·3	2·2	75·1
6. " local	15·8	15·1	·7	8·3	71·9	2·0	2·0	76·4
7. Potato, East Lothian	14·7	14·0	·7	10·0	70·9	2·5	1·9	77·1
8. Longhoughton, East Lothian	15·8	14·7	1·1	10·3	69·8	2·5	1·6	76·7
9. Goldfinder, Garton	13·8	13·6	·2	6·4	76·6	1·6	1·6	76·2
10. " Newton	14·0	13·1	·9	6·2	75·4	2·4	2·0	78·5
11. American Beauty, Newton	16·0	14·7	1·3	8·8	71·5	1·8	1·9	72·9
12. Waverley, Newton	14·5	13·6	·9	8·1	73·3	2·0	2·1	76·4
13. " East Lothian	14·4	13·1	1·3	7·5	74·2	2·0	1·9	76·7
14. Banner, East Lothian	14·5	13·8	·7	7·0	74·1	2·3	2·1	75·5
Approximate average	15·5	14·5	1·0	8·2	72·3	2·0	1·9	75·5

THE VARIATION IN THE COMPOSITION OF COWS' MILK.

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IN last year's 'Transactions'[1] the writer described an investigation which he conducted at Easter 1900 into the variation in the amounts of solids in cows' milk. In that inquiry, which involved the analysis of some 700 samples of milk, the milk of each cow in the herd at Garforth was collected and analysed separately, morning and evening, for a period of twenty-one days. The chief points brought into prominence were—

1. The very great variation in composition of the milk of individual cows from day to day, the food remaining unchanged.
2. The much larger proportion of fat present in the evening than in the morning milk of the same animals.
3. The comparative uniformity in the amounts of solids not fat, though the general average showed slightly higher values for morning than for evening milk.
4. The greater richness and constancy in composition of the milk of animals nearing the end of lactation.

Details were given as to the methods used in the determination of the fat and total solids in the samples, and of the comparisons made between the rapid methods used, with the more reliable, direct gravimetric processes. These comparisons justify the claim for accuracy of the results to within 0·1 per cent. In the experiments to be described in this paper the same analytical methods were employed, so that it is not necessary to again describe them.

The 1900 investigation was performed while the cows were entirely stall-fed and with rich, dry food. It seemed therefore desirable to repeat the investigation at a different season of the year, when the animals were at pasture, and the opportunity was taken of carrying on the new experiment for a longer period, and, in addition, of studying the effects of various changes of food upon the quantity and quality of the milk yield. The milk of each of the nineteen available cows of the dairy herd at the Manor Farm, Garforth (the Experimental Farm of the Yorkshire County Councils and the Yorkshire College), was sampled, collected, and analysed during last August and September, exactly as in the former investigation described in last year's 'Transactions.'

[1] Transactions, 1901, 5th ser., vol. xiii. p. 218.

In addition, a sample was taken by means of a sampling-tube from the mixed milk of the herd as soon as it was delivered at the dairy. These "bulk samples" were collected for a longer period, and the results of their analysis are very striking.

The results described in the present paper represent more than 1600 separate analyses of milk, collected under such conditions as to preclude the possibility of any suspicion being raised as to its genuine character.

The age, weight, stage of lactation, and other particulars of the cows are given in the following table:—

No. of cow.	Weight on Aug. 14. cwt.	qr.	lb.	Days since calving up to Aug. 10.	Number of calves.	Date when last served.
1	11	3	7	150	4	Sept. 4.
4	9	0	20	220	4	May 20.
5	12	0	21	510	3	July 18.
6	11	0	14	158	6	May 4.
7	11	2	0	74	2	July 23.
8	10	0	0	71	4	Aug. 27.
10	12	0	0	122	3	Aug. 28.
11	12	2	8	112	6	June 30.
12	11	1	11	144	3	July 3.
13	11	2	0	46	4	Aug. 3.
14	11	1	0	107	3	July 14.
16	9	3	18	68	2	Sept. 2.
17	9	3	0	55	4	July 14.
18	12	0	6	254	6	May 16.
19	9	2	16	55	3	July 15.
20	9	3	5	81	3	July 18.
21	8	1	0	85	3	Aug. 7.
22	8	3	0	83	3	July 26.
23	8	3	14	55	2	Not.

For some time previous to the commencement and during the first period of the experiment the cows received daily 2 lb. decorticated cotton-cake each, and were at pasture day and night, being brought up and milked in the cowhouse at about 6 A.M. and 3 P.M.

The mixing and sampling of their milk were performed as described in the former paper, due care being taken to obtain representative samples.

The analyses were carried out in the laboratory at Garforth, so that the trouble, delay, and inconvenience of sending the samples by rail into town were avoided.

The analyses were made, as a rule, about 17 hours after milking for the evening samples, and about 10 hours after the morning milking. As the experiments were made during very hot weather, some difficulty was found in finishing the analyses before the samples were sour. The bottles containing the samples were kept, as much as possible, in a cold cellar; but in spite of this, on several occasions souring occurred before the determina-

tions were completed. In such cases a little strong ammonia was added to the milk, and by means of a good shaking it was found easy to restore it to a sufficiently mobile condition to allow of the specific-gravity determination and the taking of a representative portion for the fat estimation. As the percentage results are only given to the first decimal place, no correction for the necessary dilution of the milk was made; such correction would be quite inappreciable so far as the fat determination is concerned, and in no case, I think, could it affect the first decimal place of the solids not fat, calculated from the specific gravity and fat by Richmond's well-known formula. This addition of ammonia was made only to a very small number of specimens.

The use of preservatives naturally suggested itself as a means of obviating the difficulty. "Formalin," though excellent as a preservative, is not suitable for the purpose, because of its action on the proteids, as described in the former paper, so only on some few occasions was it employed, and then at the cost of much time and labour in carrying out the fat estimations. Eventually the most suitable preservative was found in a 7 per cent solution of potassium dichromate containing about 31 per cent of strong ammonia. 1 c.c. of this solution was found to effectively preserve about 250 c.c. of milk for several days.

Determination of Fat.

This was done by the Gerber method, the accuracy of which had been established by repeated comparisons with gravimetric processes. Since the values for fat are only given to one place of decimals, it may safely be assumed that they are quite accurate to that degree. In carrying out the determinations one or two observations were made which may perhaps be of interest.

1. The colour of the layer of fat obtained in the Gerber tube was very different in the case of milk from different cows. Some animals gave milk which almost invariably yielded yellow fat, whilst others gave milk from which almost perfectly colourless fat layers were obtained. The most noticeable cows in this respect were Nos. 6, 20, and 8, whose milk invariably yielded distinctly yellow fat, and cows 17, 19, 7, 13, and 21, who gave milk from which very pale, almost colourless, fat was obtained.

When potassium dichromate had been used as a preservative, the colour of the fat layer was invariably much paler than usual, so that it would appear that the colouring matter of milk is largely contained in the fat-globules, and is readily destroyed by oxidation.

2. In performing the "Gerber" test, a white deposit generally

forms near the cork and mouth of the tube. A quantity of this deposit was collected, washed thoroughly with water, dried, and examined. It proved to be calcium sulphate, and its formation affords a striking proof of the large amount of calcium (about 0·11 per cent) present in milk.

Determination of Specific Gravity.

This was done, as in the previous investigation, by means of the Westphal balance. At the close of the investigation the instrument used was calibrated by comparison with a specific-gravity bottle, and a slight correction, which has been applied to all the results was found.

The observed specific gravities were calculated to 15°·5 C. by means of Richmond's slide rule, and from the corrected values thus found the amounts of total solids were calculated also by means of the slide rule, based on the formula—

$$\text{Total solids} = \text{fat} \times 1{\cdot}2 + \frac{\text{Sp. gr.} \times 1000 - 1000}{4} + {\cdot}14.$$

In the paper in last year's 'Transactions' I gave figures which showed how closely the numbers so obtained agreed with the results of direct determination by evaporation. Of course perfect accuracy cannot be claimed for values obtained in this way, inasmuch as the relative proportions of casein, albumen, and sugar no doubt vary in different samples of milk; but the errors are probably not great, and most likely fall within the limits of 0·1 per cent, to within which value only I have given the numbers.

Of the influences which affect the average composition of cow's milk the most important, perhaps, are the following:—

A. Breed.
B. Period of lactation.
C. Season of the year.
D. Time and manner of milking.
E. Food.

In addition, the age of the animal, or what generally comes to much the same thing, the number of calves she has had, might possibly have an influence, though none can be clearly detected in the figures now to be given. In this inquiry the first of these influences cannot be considered, as all the animals were cross-bred, the dairy shorthorn predominating. The remaining influences may be discussed.

B. *Period of Lactation.*

In the results published in last year's 'Transactions' a distinct connection between the composition of the milk and the period of lactation of the cows yielding it can be traced, as is evident from the following table compiled from those results :—

Period of lactation. Month.	Number of cows.	Average fat Per cent.	Average solids not fat. Per cent.	Average total solids. Per cent.
First	4	3·95	8·91	12·86
Second	3	3·40	8·84	12·24
Third	2	3·65	9·01	12·66
Fourth	1	3·70	9·00	12·70
Fifth	...	...	...	...
Sixth	3	3·83	9·07	12·90
Seventh	0	...	...	...
Eighth	3	4·27	9·34	13·61
Ninth	1	4·35	9·37	13·72
Tenth	...	...	...	...
Eleventh	1	5·48	9·65	15·13

The above table clearly indicates, and in this respect agrees with American results,[1] that the milk of a newly calved cow is rich in fat and total solids for about a month or more after calving, that it then deteriorates and attains its lowest quality in the second or third month of lactation, after which both the fat and solids not fat increase in proportion up to the end of lactation. In the present investigation the diversity of the periods of lactation was not so great as in the previous case, and consequently the results do not allow of so complete a tabulation.

Cows Nos. 6, 17, and 21 gave milk so much below the usual quality that they have been left out of the following table :—

Period of lactation. Month.	Number of cows.	Average fat. Per cent.	Average solids not fat. Per cent.	Average total solids. Per cent.
First	...	...	...	...
Second	3	3·43	8·67	12·10
Third	5	3·43	8·74	12·17
Fourth	2	3·39	8·67	12·06
Fifth	3	3·55	8·61	12·16
Eighth	1	3·45	8·78	12·23
Ninth	1	3·74	8·81	12·55
Seventeenth	1	4·21	8·48	12·69

In the compilation of this table the results obtained during the first period of the experiment—*i.e.*, during the time that all the cows were fed on the same food—have been used, so that the effect of the food is eliminated.

It will be noticed that the regularity of the change in the

[1] Report of Director, New York Agricultural Experiment Station, 1891, p. 96.

composition of the milk with advancing lactation is not nearly so well marked as in the previous experiments, though the same general tendency to improvement as lactation advances is distinctly visible.

C. *Season of the Year.*

According to previous observations, the milk obtained in winter is richest in fat, that in summer poorest, whilst in spring and autumn milk of intermediate quality is usually given.

In this connection it is well to keep in mind that the difference in composition of the milk may be attributable more to the difference in the food and condition of the animals than to the actual influence of the season. It is difficult to eliminate these other influences, and therefore to determine the real character and range of purely seasonal variations. Without attempting such a task, it is of interest to study the changes which the average composition of milk shows from one period of the year to another.

In the 1900 series the averages of all the analyses gave the following numbers:—

Fat	3·86 per cent.
Solids not fat	9·06 "
Total solids . .	12·92 "
Daily milk-yield . . .	30 lb.

In the present series the values obtained are much lower. For the first period, August 1 to August 20, the following is the mean of all the analyses:—

Fat	3·40 per cent.
Solids not fat	8·62 "
Total solids	12·02 "
Daily milk-yield . . .	24·64 lb.

The difference between these numbers and those obtained in March and April of 1900 is very great. According to Vieth and Richmond, the results of many thousands of analyses show on the average a minimum of fat (3·79 per cent) in June, and a maximum (4·30 per cent) in November, whilst the solids not fat were at a minimum (8·71 per cent) in August and a maximum (8·92 per cent) in October.

In the two Garforth investigations the conditions under which the cows were kept were very different: in 1900 the animals were housed and fed on dry food the whole time, while in the other they were out at pasture both day and night, and very little dry food—2 lb. of decorticated cotton-cake each daily—was given; moreover, the weather was extremely hot and dry, and the pasturage scanty and poor from want of rain.

In the second period, when the food of many of the cows had changed, and when the pasturage probably somewhat improved, slight improvement in the milk was perceptible. The average of all the samples examined from August 20 to September 9 gave the following numbers:—

Fat	3·46 per cent.
Solids not fat	8·69 "
Total solids	12·15 "
Daily milk-yield . . .	22·63 lb.

As already stated, cows 6, 17, and 21 gave milk of abnormally low fat-content, and perhaps their milk should not be included in these averages. If they be left out, the figures for the first period become—

Fat	3·52 per cent.
Solids not fat	8·70 "
Total solids	12·22 "
Daily milk-yield . . .	24·24 lb.

Whilst for the second period the figures would be—

Fat	3·55 per cent.
Solids not fat	8·70 "
Total solids	12·25 "
Daily milk-yield . . .	22·13 lb.

D. *Time and Manner of Milking.*

In the 1900 results one of the striking points was the great difference in the percentage amounts of fat in morning and evening milk, especially in cows yielding large quantities. The average of all the analyses gave—

	Morning milk.	Evening milk.	Ratio.
Fat . .	3·2 per cent	4·5 per cent	1 : 1·4
Solids not fat .	9·2 "	8·9 "	1 : 0·97
Total solids .	12·4 "	13·4 "	1 : 1·08
Milk-yield .	18 lb.	12 lb.	1·5 : 1

These numbers show greater differences in fat-content than are usually supposed to exist.

There appears to be little doubt that when the intervals between consecutive milkings are equal or nearly equal, the differences both in quantity and quality of the products at morning and evening are much smaller.

In 1900, too, direct experiment showed that with three animals for four days the milk secreted in the six hours between 5 A.M. and 11 A.M. was richest in fat, closely followed by that secreted between 11 A.M. and 5 P.M., while the largest

secretion, but of the lowest quality, took place between 11 P.M. and 5 A.M.

In the present investigation the milkings were done at the same hours as in 1900—viz., at about 6 A.M. and 3 P.M.—and the same kind of difference was observed. The mean of all the analyses during the first period gives the following:—

	Morning milk.	Evening milk.
Fat . .	2·72 per cent	4·09 per cent.
Solids not fat .	8·63 "	8·61 "
Total solids .	11·45 "	12·70 "
Milk-yield .	14·41 lb.	10·23 lb.

During the second period the following are the mean results:—

	Morning milk.	Evening milk.
Fat . .	2·83 per cent	4·09 per cent.
Solids not fat .	8·73 "	8·64 "
Total solids .	11·66 "	12·73 "
Milk-yield .	13·06 lb.	9·57 lb.

Or, leaving out the cows, Nos. 6, 17, and 21, whose milk was abnormally poor, the results become for the first period—

	Morning milk.	Evening milk.	Ratio.
Fat . .	2·84 per cent	4·20 per cent	1 : 1·49
Solids not fat .	8·71 "	8·68 "	1 : 0·997
Total solids .	11·55 "	12·88 "	1 : 1·12
Milk-yield .	14·19 lb.	10·05 lb.	1·40 : 1

For the second period—

	Morning milk	Evening milk.	Ratio.
Fat . .	2·95 per cent	4·16 per cent	1 : 1·42
Solids not fat .	8·78 "	8·62 "	1 : 0·982
Total solids .	11·73 "	12·78 "	1 : 1·10
Milk-yield .	12·84 lb.	9·29 lb.	1·40 : 1

In these figures it will be seen that, as in the previous investigation, the ratio of the average percentages of fat is almost exactly the inverse of that of the average yields of milk at the morning and evening milkings.

From the diagrams it will be seen that the same remarkable variation, from day to day, in the amount of fat in the milk of individual cows again showed itself. No adequate cause for these great variations can be suggested, as the conditions under which the cows existed were, so far as could be ascertained, very constant. It seems highly probable that the fluctuations in the amount of fat are really due to slight variations in the placidity and comfort of the animals, produced perhaps by such trifling circumstances as pleasant or unpleasant climatic conditions, presence or absence of troublesome insects, or other causes of excitement. That sexual excitement has the effect of

producing irregularities both in the quantity of milk and its percentage amount of fat is seen in the case of cow No. 1. This animal was in heat about the beginning of September, and was served on the 4th. Unusual variability in composition and quantity of her milk about this date is clearly shown in the diagram.

Variations so great as those exhibited are not usually recognised as occurring in cows' milk. Their detection is very improbable unless the milk of individual cows be examined, for it is unlikely that many of the animals of a herd should be similarly affected at any given time. The milk of a herd thus may be fairly constant in composition from morning to morning, or from evening to evening, and yet the milk of the individual cows composing the herd may be varying greatly. The larger the herd the less likely are these individual variations to affect the mixed milk. Milk from a large dairy is, therefore, more uniform in composition than that obtained where only few cows are kept.

E. *The Effect of Food.*

The greatest diversity of opinion exists as to the influence exerted by various foods upon the composition and quantity of the milk yielded by cows. Without considering the much-debated point—the source of the fat of milk—there is a wide-spread general impression that rich, concentrated, dry foods tend to improve the quality of the milk, while succulent or "sloppy" food has a general tendency to increase the quantity, but with a slight diminution in the proportion of solid matter.

Numerous experiments in America lead to the general conclusion that liberal feeding with food rich in albuminoids generally produces an increased yield of milk richer in fat.[1]

Danish experiments show that the addition of succulent food —*e.g.*, roots—to stall-fed cows produces an increase in the yield, but has little or no influence on the composition of the milk.[2]

Among cowkeepers in this country there is a general belief that brewers' grains, when fed to cows, produce an increased secretion of milk of poorer quality. Without denying the latter effect, it may be pointed out that wet brewers' grains contain a large amount of water, and when they are used to replace other, drier food, a large quantity would be required if the animals are to receive an undiminished quantity of real food materials. Then, too, grains are extremely liable to undergo fermentation, especially if left about in the troughs, &c., and disturbances of the digestion of the cows are very likely to ensue if the animals are allowed to eat fermenting food.

[1] Reports of the Storrs Agricultural Experiment Station, 1894-97.
[2] Report of the Copenhagen Station, 1890.

An attempt was made to ascertain qualitatively the effect of various kinds of food upon the character and quantity of the milk produced at Garforth. With this object the cows were fed for some weeks before the experiment commenced, and for the first twenty days of the experiment uniformly, each getting 2 lb. decorticated cotton-cake daily, and grazing in the same pastures. At the end of the first period of twenty days the 19 cows were divided into four lots—

Lot 1 (5 cows) were fed exactly as before.
" 2 (5 cows) had 4 lb. Chicago gluten-meal daily.
" 3 (5 cows) had 6 lb. maize-meal daily.
" 4 (4 cows) had 28 lb. fresh brewers' grains daily.

These quantities of foods were not chosen with any intention of making them equivalent to each other, for, as already stated, the object in view was simply to investigate the qualitative effects of changes of food. The gluten-meal was taken as a type of a food rich in digestible albuminoids, the maize-meal as rich in carbohydrates, while the 28 lb. of grains were given with a view to test whether the current opinion of their effect would be confirmed or otherwise.

If the albuminoid contents only of the food be considered, and the amount present in the 2 lb. cotton-cake be taken as unity, then, assuming the foods to have their usual composition, the lots would receive of albuminoids, in addition to what they obtained from pasture grass, according to the following ratios:—

Lot 1 (cotton-cake)	1	Lot 3 (maize-meal) about	0·65
" 2 (gluten-meal) about	2	" 4 (grains) "	1·60

If the amount of fat be taken as the criterion, the ratios would probably be—

Lot 1	1	Lot 2	0·63	Lot 3	0·84	Lot 4	1·80

Lastly, their relative values based on their carbohydrates would probably be about—

Lot 1	1	Lot 2	4	Lot 3	10	Lot 4	7

These ratios are approximate only, and no importance is to be attached to them.[1]

It is evident that lot 2 (Chicago gluten-meal) were receiving

[1] Actual determinations of the total nitrogen and fat in the three dry foods gave the following results:—

	Nitrogen. Per cent.	Crude protein. Per cent.	Oil. Per cent.
Cotton-cake	6·81	42·6	13 0
Gluten-meal	6·82	42·6	4·1
Maize-meal	1·48	9·25	3·6

a ration which with their pasturage would have a higher albuminoid ratio than the others, whilst lot 3 (maize-meal) had certainly the food with the lowest albuminoid ratio.

In considering the results several points must be kept in mind: an important one is that the cows are advancing in lactation, and consequently naturally tend to give, during the second period, a smaller quantity of milk richer in fat.

If we assume that the change in the yield of lot 1 is due simply to advancing lactation, or to other influences which affect all the cows alike, we can then compare the other foods as to their effect in enriching the milk or diminishing the yield.

The following tables epitomise the results:—

Lot 1.

First Period. 2 lb. Decorticated Cotton-Cake each daily.

No. of cow.		Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
5		4·21	8·47		10·05
11		3·04	8·59		35·22
12		3·27	8·28		13·82
21		2·89	8·57		27·37
22		3·49	8·84		27·95
	Mean	3·38	8·55	Total	114·41
		Second Period.	*Same food.*		
5		4·14	8·56		10·17
11		3·35	8·72		30·42
12		3·44	8·42		11·45
21		3·05	8·50		26·44
22		3·43	8·74		24·77
	Mean	3·48	8·59	Total	103·65

The gains in live-weight from August 14 to September 13 of these cows were:—

No.	lb.	No.	lb.
5	37	22	72
11	24		
12	34	Total . .	171
21	4	Average .	34·8

The diminution in daily milk-yield from 114·4 to 103·6 lb. is a diminution of 9·44 per cent. The results with these cows show that in the second period their milk-yield diminished by 9·44 per cent, whilst its fat-content increased from 3·38 per cent to 3·48 per cent, or by 0·1 per cent, and its solids not fat increased by 0·04 per cent, the cows gaining an average of 34·8 lb. in live-weight.

Lot 2.

First Period. 2 lb. Cotton-Cake each daily.

No. of cow.	Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
6	2·88	7·17		21·72
7	3·41	8·86		32·53
17	2·57	9·03		30·72
19	3·58	8·79		23·69
23	3·14	8·59		35·44
Mean	3·11	8·49	Total	144·10

Second Period. 4 lb. Chicago Gluten-Meal each daily.

No. of cow.	Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
6	3·06	7·75		20 72
7	3·43	8·84		30·57
17	2·75	9·05		28·75
19	3·63	8·85		23·12
23	3·35	8·57		32·72
Mean	3·24	8·61	Total	135·88

The increases in live-weight were :—

No.	lb.	No.	lb.
6	58	23	3
7	40		
17	28	Total . .	131
19	2	or an average of 26·2 lb.	

The results show that during the second period the cows gave 8·2 lb. less milk daily, or a diminution of 5·69 per cent; that the percentage of fat increased by 0·13 per cent, and of solids not fat by 0·12 per cent, while their live-weight increased on the average by 26·2 lb.

Lot 3.

First Period 2 lb. Cotton-Cake each daily.

No. of cow.	Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
4	3·45	8·78		18·27
13	3·57	8·64		34·20
14	3·70	8·74		29·32
18	3·75	8 81		21·72
20	3·33	8·84		22·79
Mean	3·56	8·76	Total	126·30

Second Period. 6 lb. Maize-Meal each daily.

No. of cow.	Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
4	3·32	8·77		16·77
13	3·58	8·65		28·35
14	3·69	8·81		28·55
18	3·63	8·83		21·59
20	3·17	8·79		22·84
Mean	3·48	8·77	Total	118·10

The gains in live-weight were:—

No.	lb.	No.	lb.
4	54	20	33
13	24		
14	21	Total . .	154
18	22	or an average of 30·8 lb.	

During the second period the milk-yield diminished from 126·3 to 118·1 lb., or by 6·49 per cent; the average fat fell from 3·56 per cent to 3·48 per cent, a loss of 0·08 per cent; whilst the solids not fat were not appreciably affected. The cows gained an average of 30·8 lb. in body-weight.

Lot 4.

First Period. 2 lb. Cotton-Cake each daily.

No. of cow.	Average fat. Per cent.	Average solids not fat. Per cent.		Milk-yield. lb.
1	4·02	8·74		18·79
8	3·22	8·45		24·75
10	3·36	8·83		14·62
16	3·72	8·69		25·22
Mean	3·58	8·68	Total	83·36

Second Period. 28 lb. Brewers' Grains each daily.

1	4·07	8·70		16·02
8	3·42	8·54		22·62
10	3·3[illegible]	8·77		11·89
16	3·8[illegible]	8·71		22·87
Mean	3·66	8·68	Total	73·40

The changes in live-weight were:—

No.		lb.	No.		lb.
1	gained	77	16	gained	28
8	lost	11			
10	gained	72		Total . .	166

or an average of 41·5 lb.

In the second period the milk-yield per day fell from 83·36 to 73·40 lb., a diminution of 12 per cent; the average percentage of fat increased from 3·58 to 3·66—*i.e.*, by 0·08—whilst the solids not fat remained the same. The cows showed an average increase in weight of 41·5 lb.

If the change shown in lot 1 be taken as normal, and as being due to advancing lactation, the effect produced by the three changes of food may be stated as follows:—

The *food rich in albuminoids* (lot 2) produced an increase of 3·75 per cent of milk, richer in fat by ·03 per cent, richer in

solids not fat by ·08 per cent, but the body-weights of the cows were diminished by an average of 8·6 lb. during the experiment.

The *food rich in carbohydrates* (lot 3) produced an increase of 2·95 per cent of milk poorer in fat by ·18 per cent and poorer in solids not fat by ·03 per cent. The live-weight was diminished on the average by 4 lb.

The *brewers' grains*, contrary to what was expected, produced a diminution of 2·56 per cent of milk, a diminution of ·02 per cent of fat, and a diminution of ·04 per cent of solids not fat. The live-weight increased by an average of 6·7 lb.

The change produced, it will be seen from the above figures, is small in all cases, and it might be thought that, inasmuch as the analyses only give the percentages of fat and of solids not fat to 0·1 per cent, the differences indicated are too small to be measured. It must be remembered that the figures are deduced from the differences between the means of two sets of analyses, each set containing 40 independent values for the milk of each cow. That the changes were in the direction indicated, therefore, I think we may feel tolerably certain, but any conclusions that we draw from this investigation as to the influence of food must be applied only to similar cases. The extreme dryness of the summer and autumn, and the consequent scantiness of pasturage, may have had a considerable influence, and the feeding of grains to cows at pasture is an unusual practice. Quite different results might be obtained from similar experiments with stall-fed cows. The number of animals under experiment, too, was not large enough to sufficiently remove the influence of their individuality. Moreover, advancing pregnancy may have had different influences in different animals. Problems of this character can only be successfully studied statistically, and before any really reliable generalisations can be reached large numbers of experiments will have to be made.

Another important question which this investigation fails to throw any light upon is, whether the changes in milk produced by change of food are only temporary or last for any appreciable time. It seems highly probable that the mere fact of changing the food may stimulate the vital processes of the animals and so alter their milk, but that when this stimulus has disappeared, the old order of things may be restored and the milk may return to its normal condition.

The Mixed Milk of the Herd.

The greater portion of the milk was used in the dairy, and samples from the milk "churns" were taken immediately upon their arrival. The milk of certain cows, however, was not mixed

with the bulk—*e.g.*, the milk of No. 6, which was abnormally poor. Moreover, several gallons were kept back at each milking for calf-feeding, &c. Thus the bulk samples do not necessarily represent the composition of the mixed milk of the whole herd, but in all probability they are somewhat better rather than inferior to a mixture of all, inasmuch as notably poor milk was not included. In the diagram which gives the percentages of fat found in these samples from about the beginning of July until the middle of September, the low percentage of fat in morning's milk and the slight variation shown by the fat are the most noticeable features.

The lowness of the fat in morning's milk is especially significant in view of the recently adopted standard.

As the diagram shows, the average percentage of fat in the morning milk, as delivered in the dairy during a period of more than ten weeks, was only 2·69, and only on some eight occasions did it reach 3 per cent, while once (on August 26) it fell below 2 per cent. On this date the average of all the samples of the morning milk of the cows was 2·30 per cent fat. The difference between the two numbers is easily accounted for: those cows which gave the largest yield, and whose milk would therefore have the greatest influence upon the character of the bulk, were those which gave very poor milk—*e.g.*, cows Nos. 7, 17, 21, 23, whose milk contained, on this particular morning, only 1·75 per cent, 1·35 per cent, 1·45 per cent, and 1·80 per cent respectively. The use of the milk of some of the cows for calf-feeding would also tend to prevent the average of all the samp' agreeing with the bulk.

In the evening the average amount of fat found in the mixed milk was 4·03 per cent, the highest proportion, 4·8 per cent, occurring on August 3 (which was a cool, dull day following several exceedingly hot ones). On this date the separate milk of almost all the cows was of unusually high quality, and the average of all the amounts of fat found was 4·7 per cent.

It is evident from the above figures that the interpretation of the new regulations for the sale of milk which has been put upon them by certain magistrates—viz., that all milk must contain 3 per cent of fat, or otherwise must necessarily be adulterated and the purveyor therefore convicted—may lead to grave consequences to perfectly upright cowkeepers, and that if a milk producer is to avoid such trouble it will be necessary, in many cases, to enrich the morning's milk of shorthorn cows by admixture with Jersey or Guernsey milk. It seems highly probable, however, that such an interpretation of the regulations is not intended, and that it is the desire of the Board of Agriculture to ensure that the genuine produce of normally healthy cows, milked fully

from the animals, shall be supplied, and that should a sample of milk on analysis be found to contain less than 3 per cent of fat, adulteration is not proved, but that the onus of bringing forward evidence to prove his innocence then falls upon the purveyor of the milk.[1]

Summary of the Results.

The following general conclusions may be drawn from the results given in this paper:—

1. The percentage of fat in the milk of individual cows is liable to enormous variation from time to time, from causes which are unknown.

2. Morning milk is much poorer in fat than evening milk, though slightly richer in solids not fat and more abundant. This statement applies to cases where the night interval is much longer than the day.

3. The percentages of fat and of solids not fat in milk tend to diminish for two or three months after calving, and then steadily increase as lactation advances.

4. Foods rich in albuminoids—*e.g.*, gluten-meal—seem to improve both the yield of milk and the proportions of fat and solids not fat, at least for a time, while large quantities of carbohydrates, though slightly increasing the yield, appear to diminish its quality.

5. The mixed morning milk of a herd may often fall below 3 per cent of fat in the late summer or autumn, if the milking be performed at the usual unequal intervals.

Explanation of the Diagrams.

The results of the analyses and the weight of milk yielded at each milking by each cow is recorded in the accompanying diagrams, which will be readily understood. The number of actual data (nearly 5000 independent quantities) obtained is so great that if numerals were used the array of figures would be very formidable.

In the diagrams not only are all the results recorded in such a way that the values for any particular milking of any cow can readily be found, but the general alteration in the values over a period of time can easily be seen.

In the first ten diagrams the results of the analyses of the separate milks of all the animals, at morning (dotted line) and evening (black line), together with the respective milk-yields, are recorded. The dates are given at the top of each diagram; the figures in the vertical column on the left-hand side indicate percentages as applied to fat and solids not fat, whilst with

[1] See circular issued by the Board of Agriculture on December 28, 1901.

reference to the milk-yield they represent, practically, gallons (actually the number of portions of 10 lb. each, or the milk-yield is given in pounds on a scale $\frac{1}{10}$ that of the percentages of fat and of solids not fat). The distance between two of the fine horizontal lines thus corresponds to 0·2 per cent of fat or solids, or to 2 lb. of milk in the milk-yield.

Each diagram is divided into two halves representing periods of twenty days each, in accordance with the change in the food. The mean values for each period of each of the six quantities determined—solids not fat in morning and evening milk, fat in morning and evening milk, and the yield of milk at morning and evening—are given to left hand for the first, to the right for the second, period.

The stall food of the cows has already been given, but for convenience that for the second period is printed under each diagram. As already stated, during the first twenty days all the animals were fed alike—2 lb. decorticated cotton-cake each daily.

In all cases a dotted line refers to morning milk, a black line to evening milk, while the figures at the top of the vertical lines give the dates of milking.

Figs. 95 and 96 show the highest and lowest percentages of fat observed, during the whole period of 40 days, in the milk of each cow, morning (M) and evening (E). Also by the height of the light central column the average percentage of fat of all the samples from each cow. The greatest range in variation (from below 2 to above 8 per cent) was shown by the milk of cow No. 14, whilst cow No. 13 had the smallest range (from about 2·3 to 4·9 per cent). Cow No. 5 had the highest average of fat (4·2 per cent), and No. 17 the lowest (2·7 per cent).

In fig. 97 are recorded the percentages of fat found in the mixed milk as delivered twice daily at the dairy from July 8 to September 17.

In the lower part of the diagram at the right hand is given a graphical representation of the extreme variation shown in the fat content of the mixed milk: this shows a great similarity to the similar diagram for cow No. 12 (on fig. 96).

In figs. 95, 96, and 97 the space between two of the fine horizontal lines corresponds to 0·1 per cent of fat.

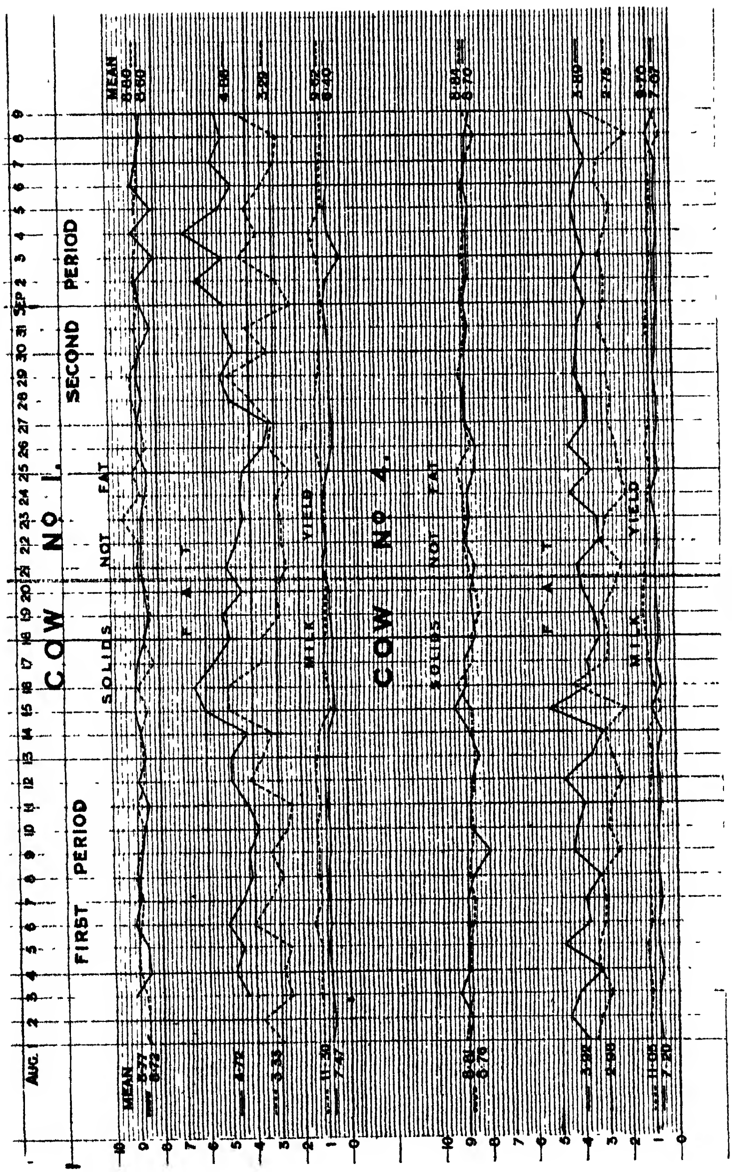

Fig. 85.

Stall food during second period : Cow No. 1, 28 lb. brewers' grains daily. Cow No. 4, 6 lb. maize-meal daily

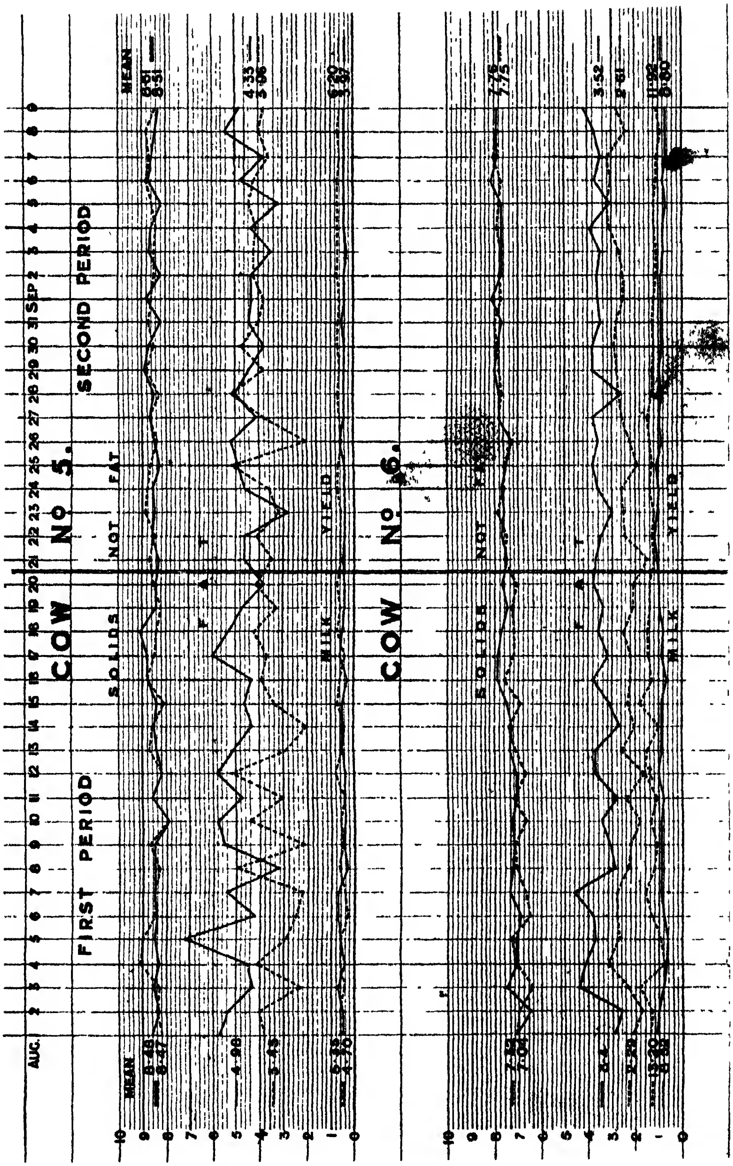

Fig. 86.

Stall food during second period : Cow No. 5, 2 lb. cotton-cake daily. Cow No. 6, 4 lb. Chicago gluten-meal daily.

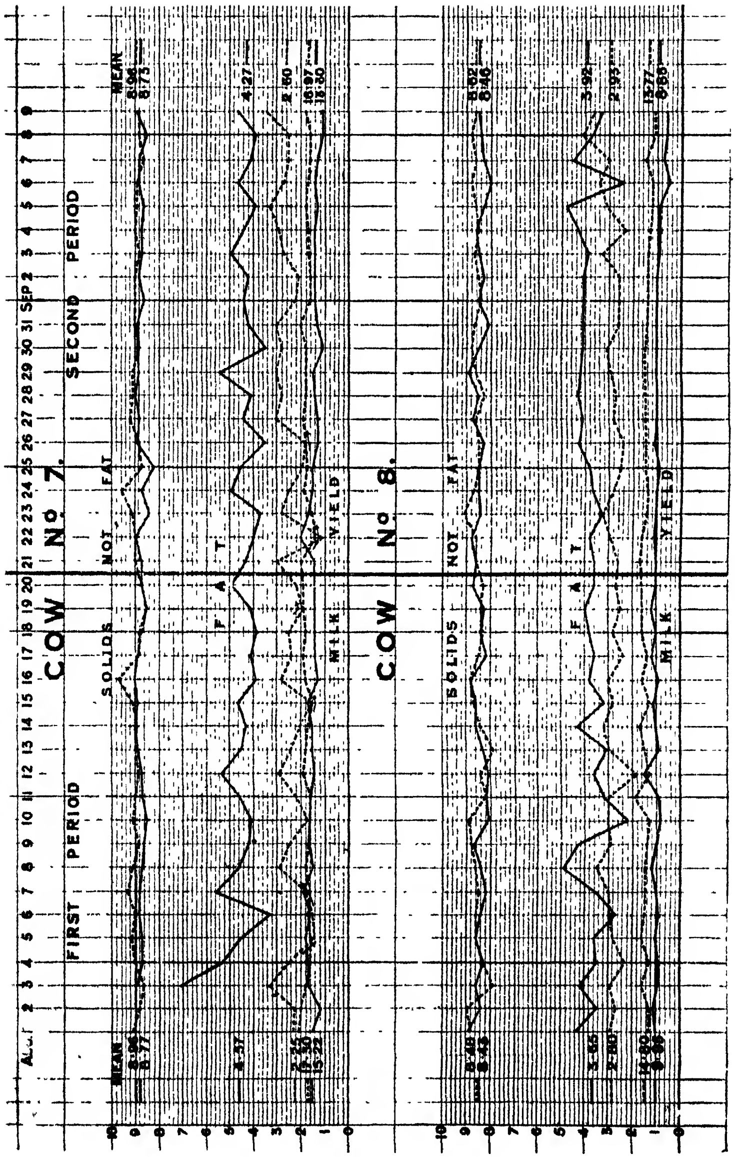

Fig. 87.

Stall food during second period: Cow No. 7, 4 lb. Chicago gluten-meal daily. Cow No. 8, 28 lb. brewers' grains daily

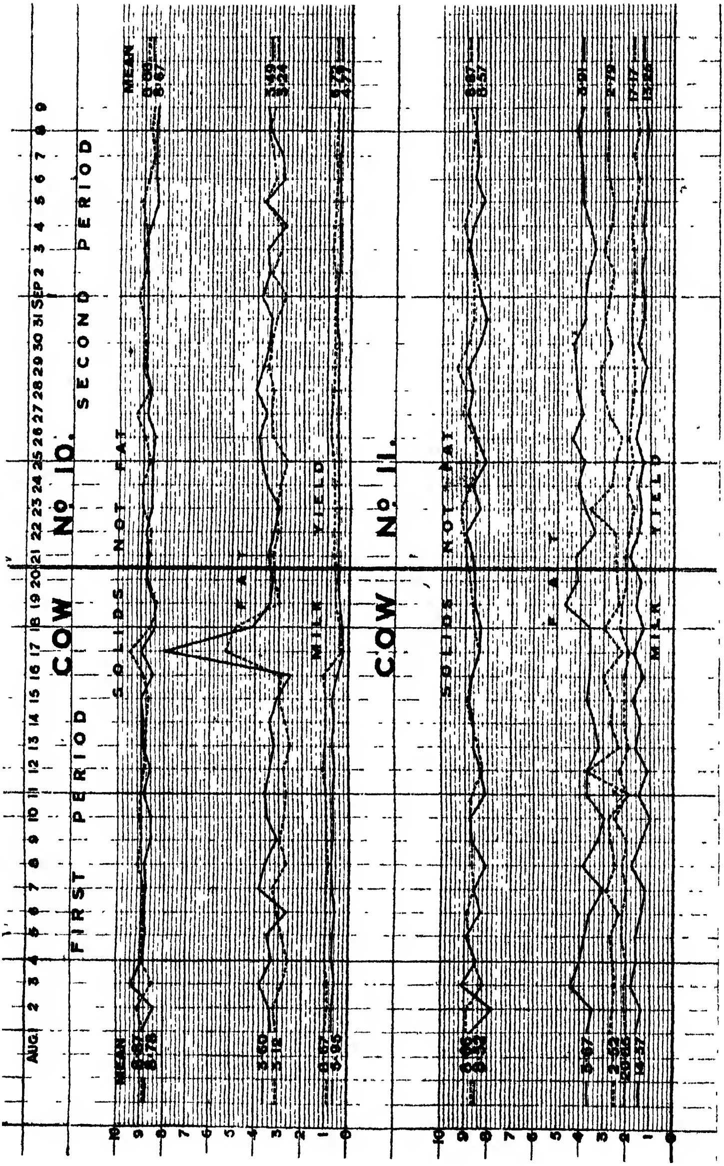

Fig. 88.

Stall food during second period: Cow No. 10, 28 lb. brewers grains daily. Cow No. 11, 2 lb. cotton-cake daily.

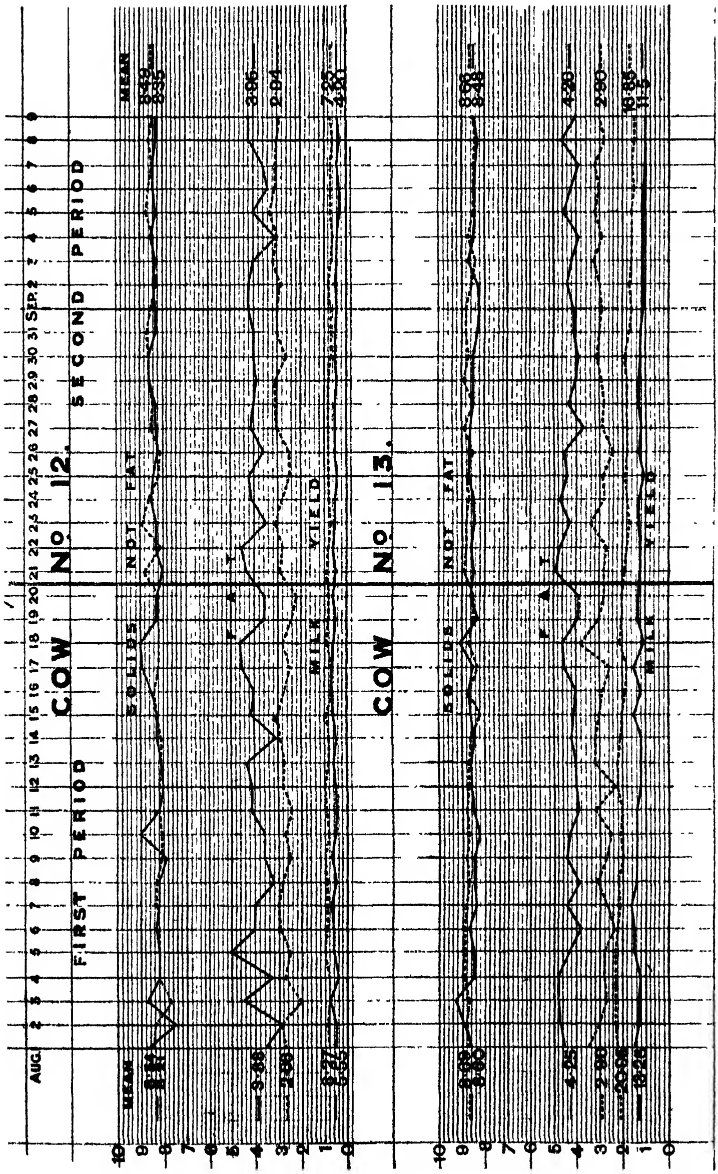

Fig. 89.

Stall food during second period : Cow No 12, 2 lb. cotton-cake daily. Cow No. 13, 6 lb. maize-meal daily.

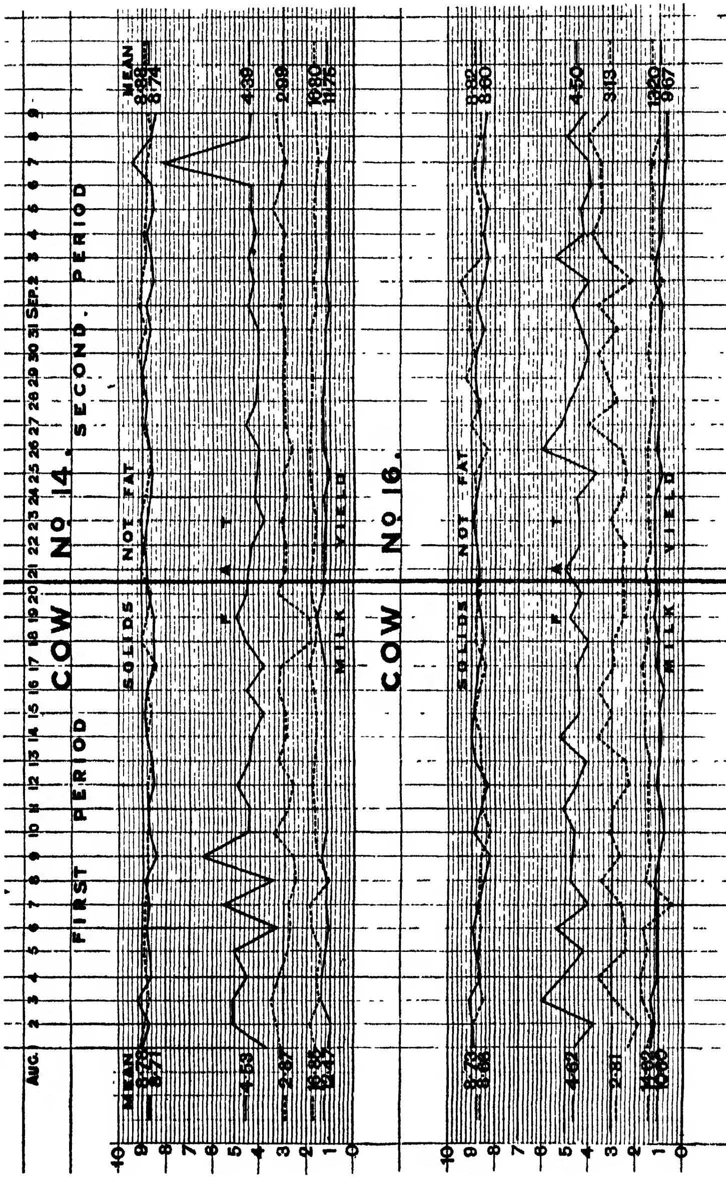

Fig. 90.

Stall food during second period: Cow No. 14, 6 lb. maize-meal daily. Cow No. 16, 28 lb. brewers' grains daily.

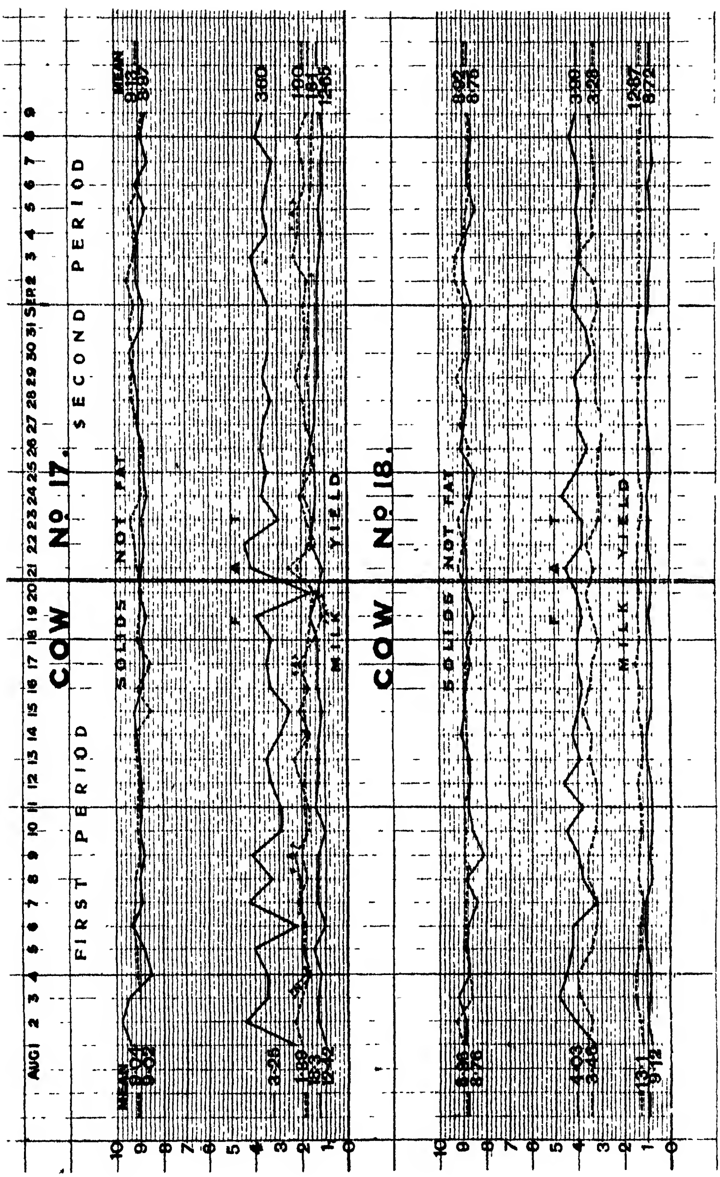

Fig. 91.

Stall food during second period : Cow No. 17, 4 lb. Chicago gluten-meal daily   Cow No. 18, 6 lb. maize-meal daily.

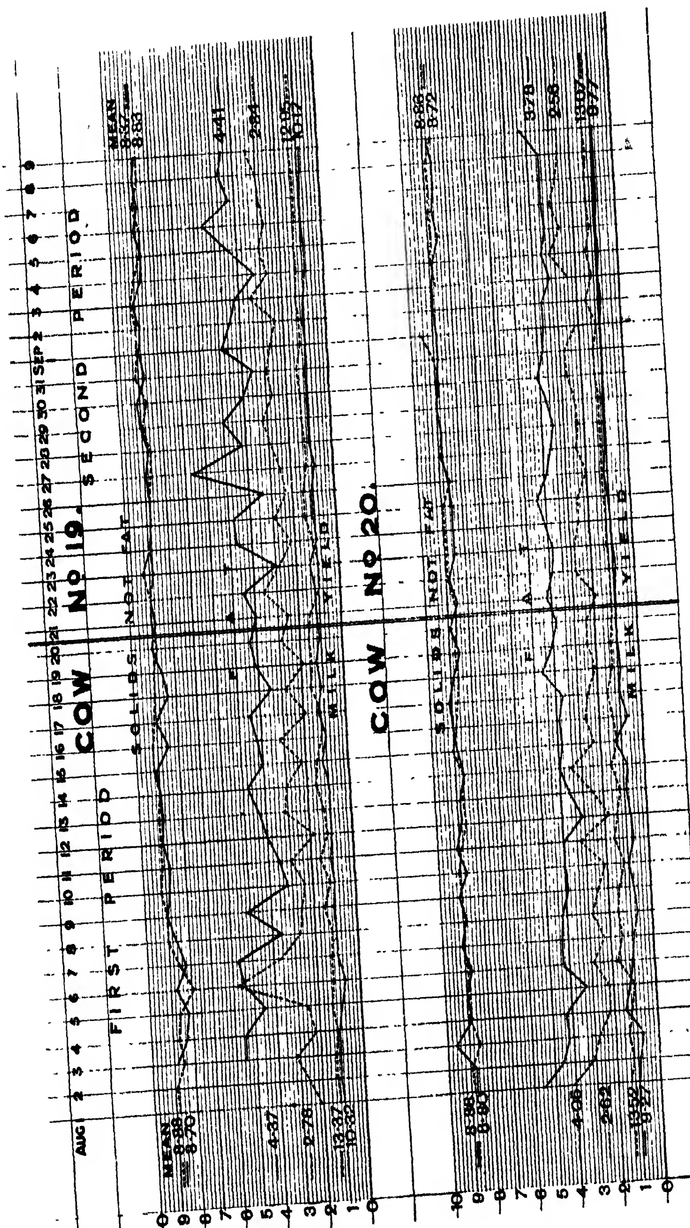

Fig. 92.

Stall food during second period: Cow No. 19, 4 lb. Chicago gluten-meal daily. Cow No. 20, 6 lb. maize-meal daily.

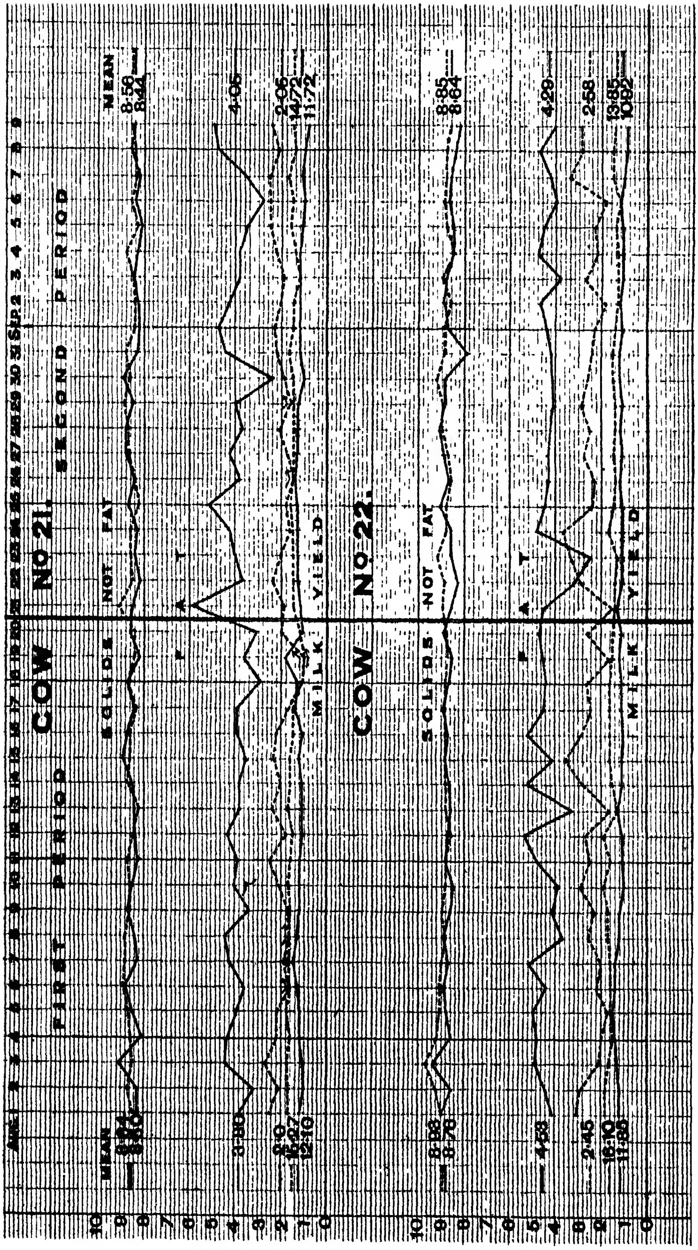

Fig. 93.

Stall food during second period : Cow No. 21, 2 lb. cotton-cake daily. Cow No. 22, 2 lb. cotton-cake daily.

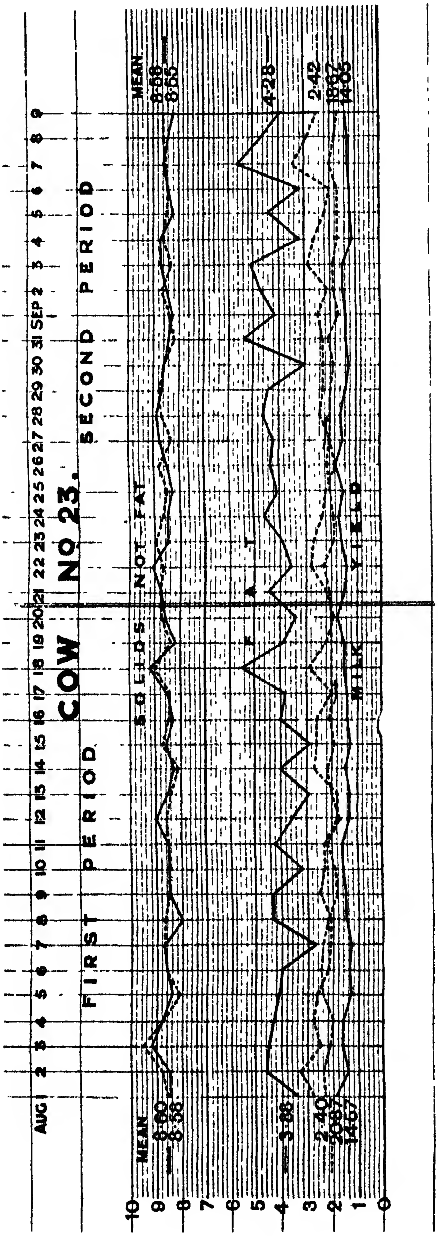

Fig. 94.

Stall food during second period: Cow No 23, 4 lb. Chicago gluten-meal daily.

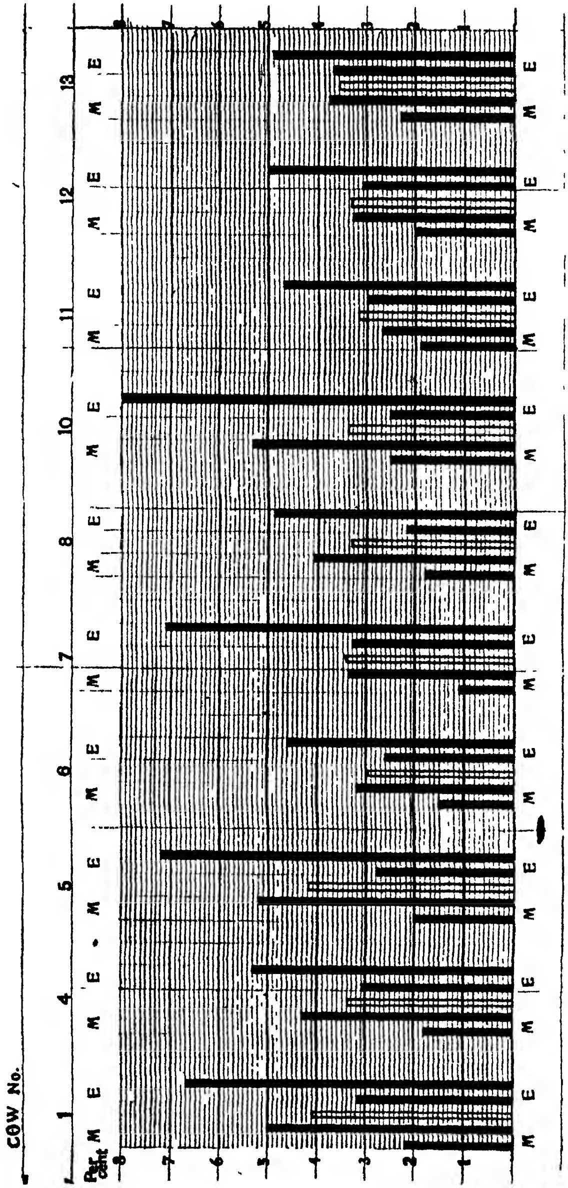

Fig. 95.

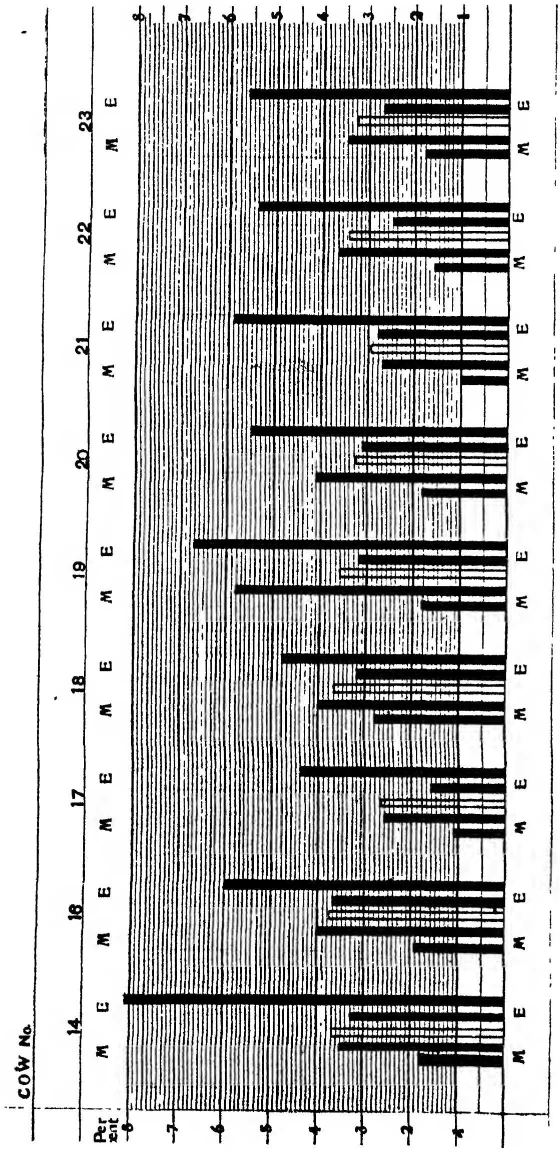

Fig. 96.

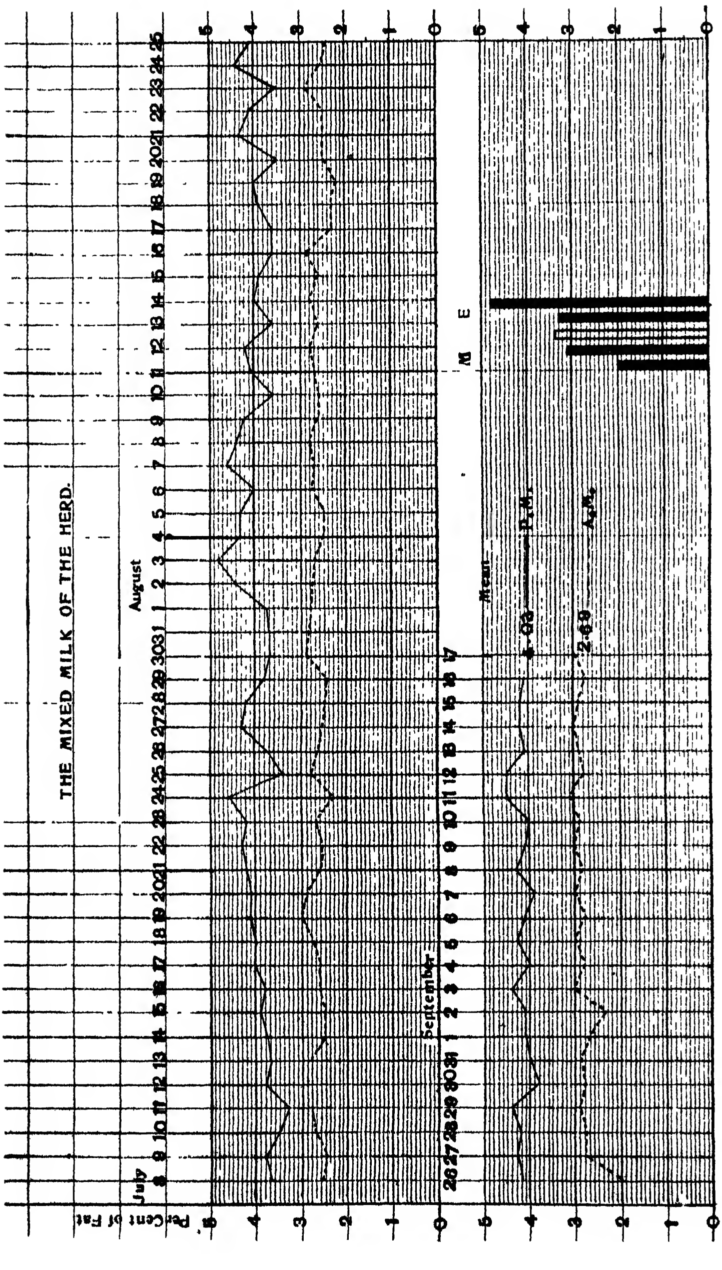
THE MIXED MILK OF THE HERD.
Per Cent of Fat
July
August
September
M E
Mean
D.M.
A.M.
4·03
2·69

Fig. 97.

ON BRAXY.

By D. J. HAMILTON, Professor of Pathology, University of Aberdeen.

IN the year 1881 the Highland and Agricultural Society appointed a Committee to investigate the diseases of sheep known as "louping-ill" and "braxy," and I was asked to accompany that Committee to the island of Skye, where the first investigations were undertaken. So far as braxy is concerned, our visit to the island of Skye was timed too early in the season; but those cases which came under my notice later on convinced me, in the first place, that nothing was known of the ætiology of the disease, and, in the second place, that the disease was well worthy of investigation. At that time, bacteriological technique was in a comparatively undeveloped condition, and this proved a great stumbling-block to the progress of the inquiry. The Committee gathered a good deal of information regarding its symptoms and distribution, and had an opportunity of learning the traditions held by flock-masters, shepherds, and others as to the morbid appearances which characterise the disease, and the prevalent notions as to its cause and prevention. Further than this, however, the labours of that Committee did not add much to our knowledge of the nature of braxy, nor did they throw much light upon how it is spread.

Ever since that time, however, I resolved to continue the investigation on my own account when opportunity proved favourable, and accordingly, in the autumn of 1897, I resumed the inquiry, and have carried it on since that date up to the present. Quite lately the Board of Agriculture has appointed a Departmental Committee, of which I have the honour to be a member, to report upon the above two diseases, and it is to the Report which will be issued by that Committee that I would direct your readers' attention for more extended information.

Meanwhile, however, as the Highland and Agricultural Society kindly granted me a sum of money last year to continue the research, perhaps a preliminary account of this disease, embodying a synopsis of my observations and experiments up to the present date, may not be unwelcome.

The ground over which I have worked, the neighbourhood of Fort-William, is perhaps more infested with braxy than any other part of Scotland. I have visited it every winter or autumn since the year 1897, sometimes several times in a season, and

have never failed to see plenty of cases. And here I must return my thanks to the flock-masters in the district for the great kindness they have shown me by putting every facility for observation at my service, and for the interest they have shown in the progress of the inquiry. The difficulties of pursuing a research of this kind in such an outlying district, and often in the depth of winter, are, as may be imagined, considerable; but these were minimised by the obliging attention I received on all hands. Much of the experimental work was conducted in my laboratory at Marischal College, Aberdeen, during the intervals between the braxy seasons, but a large proportion of it, for reasons to be afterwards explained, had to be put in practice in the infected districts.

Nomenclature.

The disease is known in the West Highlands as "braxy," but in the midland counties of Scotland it is often called "sickness"; while in Germany, Denmark, Norway, and Iceland the disease goes by the name of "Bradsot" or "Brasot." Not so very long ago, so little attention had the malady received at the hands of our agricultural authorities, there was some doubt as to whether the two diseases "braxy" and "Bradsot" were the same. My own experience proves beyond question that they are identical, and this is also the opinion of those who have gone into the matter in Norway and elsewhere. Gamgee[1] derives the name "braxy" from the Gaelic *broc* or *brac*, signifying sickness—that is to say, *the sickness* or that form of disease which prevails more than any other in a district. The terms "Bradsot" and "braxy," however, have a certain resemblance; and philologically it may be a question whether the word "braxy" is not a lineal descendant of "Bradsot," and whether both are not of Scandinavian origin. The term "Bradsot" means "sudden sickness," and undoubtedly has reference to the most tangible symptom of the disease—namely, its sudden onset and the rapidity with which it runs its fatal course.

Historical.

The occasional references to it in the early literature of Scotland show that braxy has been endemic in this country from remote periods; and the intelligent descriptions of the disease given in a series of prize essays sent in to the Highland Society and summarised by Dr Duncan,[2] in the essay by Stevenson in that same publication, and particularly the most observant account, according to his lights, given later on by the shepherd, W.

[1] Our Domestic Animals, vol. iii. p. 292.
[2] Prize Essays and Trans. Highland and Agricult. Soc., vol. iii. 1807, p. 339.

Hogg,[1] show that the disease must have been firmly established in this country, and entailed tremendous loss, at the end of the eighteenth and beginning of the nineteenth centuries. In Scotland, however, it has assumed more serious proportions during the nineteenth century on account of the increase which has taken place in sheep-farming in the West Highlands. Sheep-farming in the West Highlands of Scotland dates only from the beginning of the nineteenth century, but has now grown to such an extent that it constitutes one of our largest industries. Previous to the nineteenth century, the land now grazed over by sheep was almost entirely given up to the rearing of cattle, the few native sheep to be found here and there being mostly in the hands of crofters.

Krabbe[2] has collected all the Icelandic and Danish literature bearing upon the disease, and traces it backwards in Iceland to the middle of the eighteenth century. Early records of the disease in the Faröe Islands are wanting, owing probably to an absence locally of veterinarians or others qualified to render an intelligent account of it.

More recently, in our own country, essays on braxy have appeared from time to time, but the chief drawback to these is that they are mostly by laymen, untrained in veterinary or human medicine, and giving consequently only a somewhat popular account of the symptoms and the appearances presented after death. Such are the essays of Cowan and Borthwick,[3] and Robertson,[4] which, excellent as they are from a layman's point of view, are lacking in what might be termed "trained evidence." Somewhat of the same nature are the accounts of the malady by the Icelanders, J. Sigurdsson,[5] S. Jónsson,[6] and G. Einarsson.[7] The first really scientific account of the pathology of the disease is that by the Norwegian Government veterinary officer, Ivar Nielsen, who likewise must be regarded as having discovered the micro-organism which is its cause.[8] Previous to the publication of Nielsen's paper in 1888, and even for some time afterwards, the malady was considered to be anthrax. Williams[9] looked upon it as an anthracoid disease—as a form of septicæmia simulating anthrax in its post-mortem appearances, but exhibiting no con-

1 Prize Essays and Trans. Highland and Agricult. Soc., vol. i. 1829, p. 44.

2 Bradsoten hos Farene i Island og paa Faeröerne. Tidsskrift for Veterinaerer, 1872.

3 Trans. Highland and Agricult. Soc., July 1861–March 1863, p. 18.

4 Ibid., July 1863–March 1865, p. 79.

5 Um brádasóttina á Íslandi og nokkur rád vid henni, 1876.

6 Um brádafárid i saudfè, 1873.

7 Um brádapestina og tilraunir til ad varna henni, 1876.

8 Tidsskrift for Veterinaerer, 1888; *also*, Norsk Landsmandsblad, 1892; *also*, Monatshefte für prakt. Thierheilkunde, Bd. viii. Hft. 2, 1896, p. 55.

9 Principles and Practice of Veterinary Medicine, 1888, p. 304.

tagious properties and presenting no specific germ. Indeed, in a note of earlier date,[1] he did not go so far as this, but, from several opportunities he had of seeing braxy, had come to the conclusion that it is nothing more than an acute form of indigestion, with inflammation of the bowels and flatulence, arising from eating food in a more or less fusted and decomposing condition. Even so late as the year 1893, Steel in his work on 'Diseases of the Sheep' (pp. 45, 46) concurs in the prevalent notion that braxy is simply another name for anthrax. In fact such was the view which in this country and elsewhere was almost universally accepted for long after Nielsen's paper was published, and, curiously, the tradition, here and there, still lingers amongst us. Harvey[2] was opposed to this view, so far at least as his experience went of a disease closely simulating braxy, if not identical with it, which prevails in Cornwall.

The publication of Nielsen's paper, however, put all these doubts at rest. Bradsot or braxy has nothing to do with anthrax, although occasionally the symptoms of the one may simulate those of the other. His publication was followed by that of Jensen,[3] a paper which cannot be too highly rated for the masterly *résumé* it gives of what was then known of the disease, as well as for containing much original experimental evidence bearing upon it.

In the beginning of the year 1896 the Norwegian State veterinary, I. N. Bruland, was sent to investigate the disease in Iceland, and the results of his visit are incorporated in papers contained chiefly in the Norsk Veterinaer-Tidsskrift.[4] He brought home materials with him which were subsequently worked up by Jensen and himself, and from which Nielsen's bacillus was obtained in abundance.

Nature and Definition.

As above stated, braxy is certainly not anthrax. Braxy has been known from earliest times in Iceland, while anthrax has been introduced, and apparently through the intermediation of imported skins, only quite recently. There is another disease, however, with which it has even closer points of resemblance, namely, quarter-evil (Rauschbrand). Quarter-evil is said to be unknown also in Iceland, and the two diseases, and the organism causing them, when compared, are readily enough distinguishable. Thus braxy is never accompanied by any external lesion,

[1] Trans. Highland and Agricult. Soc., vol. xvi. 1884, p. 303.
[2] Some Blood Diseases of Sheep. The Veterinarian, vol. lxii. 1889, p. 892.
[3] Deut. Ztschr. für Thiermedicin und vergleichende Path., vol. xxii. 1896, p. 249.
[4] Vol. viii. Hft. 4, 1896, p. 89; *also* vol. ix. Hft. 2 and 3, 1896, p. 33; *also* vol. ix. Hft. 2 and 3, 1897, p. 77.

as is the case in quarter-evil; it also runs a much more rapid course than that disease.

Braxy is, therefore, neither an anthracoid disease nor is it to be confounded with any other malady; it is a disease *sui generis*. My own experience leads me to believe, notwithstanding all the varieties described from time to time, that, as in the case of anthrax, there is only one form which braxy assumes, and that the true point of diagnosis is the presence in the blood, liquids, organs, and tissues of the body of the characteristic organism.

Nielsen[1] has defined it as a gastromycosis, excited by a specific bacillus introduced with the food into the fourth or true stomach, and believes that the disease may either pass into a general affection, or may occasion the death of the animal through absorption of bacterial toxines formed by the organism germinating locally in a part. In these views he was supported by Jensen, who concluded as a result of the researches of previous investigators that Bradsot is an acute, or even extremely acute, infectious disease which begins as a hæmorrhagic inflammation of the mucosa of the fourth stomach, which is accompanied by the formation of gas in the alimentary canal, specially in the stomach, and which kills the animal in some cases by a general infection, in others apparently by toxic poisoning, or possibly in others still by dyspnœa caused by tympanitis. He held that the bacillus is introduced with the food, and that braxy thus differs materially from quarter-evil, which, according to Kitt's experience, he says, is seldom or ever induced by administration of the organism by the mouth. He would also stigmatise the fourth stomach as the organ primarily and most severely affected. Too much emphasis, it seems to me, has been placed upon the stomach lesion as an essential feature of the malady. In my experience the sloughy hæmorrhagic patches found on the mucous membrane of the fourth stomach in some cases are completely absent in others, and the large inflammatory patches described as occurring on the outside of the rumen or other division of the stomach, I feel convinced, have nothing to do with inflammation, nor are they hæmorrhagic. They are simply part of the general blood-staining which ensues after death. No one, moreover, as Jensen himself confesses, has conferred braxy on the sheep or any other animal by feeding with the bacillus, and this result coincides with my own experiments. I have fed sheep on the blood, peritoneal liquid, and other liquids taken from animals dead of braxy, and which were teeming with the bacillus, and have never once succeeded in conveying the disease to the fresh host by this means, while the same liquids

[1] Monatshefte für praktische Thierheilkunde, vol. viii. Hft. 2, 1896, p. 58.

injected subcutaneously killed the animal in a few hours. Jensen gets over this difficulty by affirming that the herbage at the time braxy breaks out is cold, often of a rough nature, and a good part of it indigestible, and that this predisposes the animal to infection from the stomach. Such may be the case, and it will be my endeavour in the further researches to be carried on by the Government Committee to test this theory experimentally.

It seems to me, however, that too much importance has also been attached to the lesion sometimes found in the stomach as evidence of the disease being communicated through that organ, for I have found in animals which died by the introduction of the bacillus experimentally under the skin of the thigh, that sometimes the sloughs on the stomach were most typical (see *e.g.*, case No. 7). My own impression is that it is a general disease, and that very soon after it is established the whole of the liquids, organs, and tissues become more or less beset with the bacillus. I have never failed to find it, and in greater abundance than elsewhere, in the serous and blood-stained effusion into the peritoneum, and in that contained in the pleural cavities. How it gains entrance to the animal's body is a problem which I have not as yet been able to solve to my satisfaction. Future research may show that the organism is contained in the herbage, and that the fourth stomach is the portal of entrance, but as yet this is quite undecided.

Its Distribution.

One of the most remarkable facts connected with the disease is that of its partial distribution. So far as known, it is peculiar to European sheep, but certain countries in Europe appear to be quite exempt from its ravages; and what is still more remarkable is the fact that in countries subject to the disease, it is confined to certain districts. Thus, in Great Britain it is very common along the West of Scotland, including the various western islands such as Skye and Mull. It extends down as far as Argyllshire, and with the exception of its alleged occurrence in one district, Carrick, it disappears in Ayrshire to reappear in Wigtown and Dumfries. A few cases occur apparently in the north of Cumberland, but, with this as a limit, it ceases again, until it apparently breaks out afresh in Cornwall. Whether the disease of sheep which prevails in Cornwall is braxy, or whether it is quarter-evil, appears to be somewhat doubtful. From Harvey's paper on "Some Blood-diseases of Sheep,"[1] as well as from information I have received in a letter quite recently from the

[1] *Loc. cit.*

author, the malady which prevails in Cornwall seems to correspond closely with braxy, and a stomach which he kindly sent me showed lesions which might have been due to the disease.[1] Other parts of England appear to be free from it. This is, roughly, the area of its distribution on the West coast of Great Britain. On the East coast of Scotland the disease is very much less prevalent than on the West, so much so, that West coast hoggs are sent to winter on the East coast in order to escape the havoc caused by it. It is practically unknown in Aberdeenshire—at any rate for many miles inland, and the same is said to be the case in Forfarshire; and although sporadic cases apparently occur in Nairnshire and elsewhere, yet it may be said that immunity to the disease prevails more or less along the whole of the East of Scotland. The disease diminishes in frequency from the West coast to the East, being worst nearest the sea, and decreasing from this progressively across the country. The disease also prevails—or at any rate is said to prevail—in Teviotdale and Lanarkshire, but I should like to have more definite information on the subject before concluding that this allegation is correct.

Iceland is apparently a perfect hotbed of the disease, and the same may be said of the Faröe Islands. So far as can be made out, it seems to spread equally over these islands, but perhaps more accurate statistics would have to be forthcoming before this conclusion is accepted.

From Ivar Nielsen's official report on the disease, it seems that it prevails along almost the entire coast of Norway, between Tromsö in the north and Stavanger in the south, and that it extends inwards only for a few miles.

The Shetland Islands are more or less subject to it; the island of Fetlar, apparently, is notorious.

In Mecklenburg the disease has been noticed of late. Whether it has prevailed there for long, or whether it has been recently imported, does not seem quite clear. F. Peters, veterinary surgeon in Schwerin, writing in 1897, says[2] that the disease has been known in Mecklenburg for the last ten years, that it corresponds with that described as prevailing in Iceland and the Faröe Islands, and that it has not been recognised heretofore, owing to its being confounded with "malignant œdema."

Influence of the Gulf Stream.

So far as I am aware these are the only countries, and districts of countries, in which the disease prevails, and on looking at the

[1] Unfortunately the stomach had been preserved in a chrome salt, and was so altered by it as to be practically useless for investigation.

[2] Berliner tierärztlichen Wochenschrift, No. 15, 1897, p. 174.

accompanying map (fig. 98), which represents graphically the areas of distribution, it will be noted that, in the first place, the disease is met with more frequently on the West coast than the East; in the second place, that the nearer the coast the more

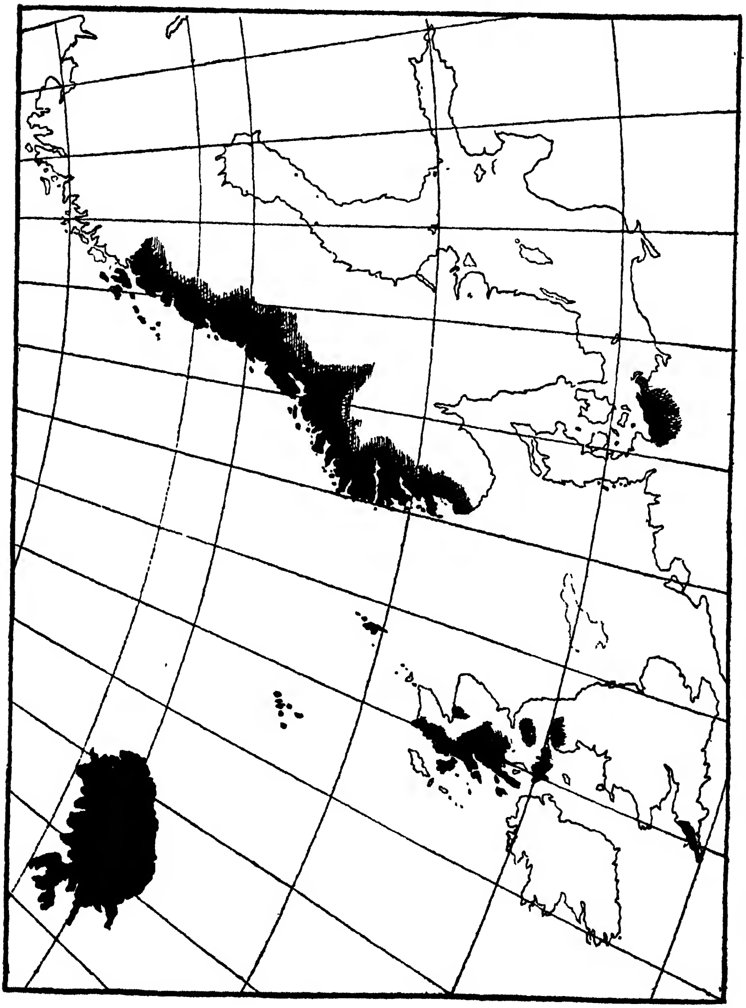

Fig. 98.—*Map showing in a graphic manner the locality of braxy-infected countries and districts.*

intense the disease; and, in the third place, that all the affected areas are more or less subject to the influence of the Gulf Stream. Why the disease should follow this particular course is a mystery. It may be that the moist warmth of the West

coast tends to engender the organism which is its cause, and that the keener climatic conditions of the East coast are less favourable to its growth.

Mortality and Pecuniary Loss.

Cowan [1] said that the greatest number of deaths which came under his own observation in seasons considered severe ranged from 15 to 20 per cent; while upon particular farms in the same district 20 to 25 per cent was held to be only a moderate loss. Upon a large hill farm in Selkirkshire, where the disease might have been said to be only present or little more, the mean annual loss for the last thirty years had been 1½ per score, or nearly 8 per cent. Upon some farms on Tweedside the loss was not much less than from 30 to 35 per cent; while in the West Highlands, he had it from undoubted authority, that upon lands where hoggs were wintered at home, and where a portion of the older sheep die of braxy, the annual loss ranged from 30 to 40 per cent, and, in Morven, sometimes as high as 45 to 50 per cent. So severe, he says, is the disease in some parts of Argyllshire that it would be hard to say what the annual loss would be were the hoggs wintered at home.

From extensive inquiries made in many districts of the West Highlands, Robertson [2] came to the conclusion that there were few sheep-owners who lost less than 25 per cent of their hoggs from braxy, in a few months, every year. Three years ago, he himself lost 40 per cent; and a neighbour told him that his mortality amounted to two-thirds of his entire hoggs. To be within the mark, he takes 20 per cent as the average loss. The hoggs which die would, he says, have been worth twenty shillings in May, and he reckons the gross loss on each hogg, all things considered, as at least twenty-two shillings and sixpence. Braxy, he states, moreover, carries off annually almost as many as can be sold each year from the farm, a condition of affairs which is not of merely temporary occurrence, but which has been the normal state of matters from which sheep-farmers have been suffering, year by year, for generations past.

Writing of the mortality in Teviotdale the shepherd, W. Hogg, said [3] that out of a yearly hirsel of 700, he had seen sometimes 100 die from braxy, but in other seasons not more than 40.

Jensen [4] quotes some statistics bearing upon the loss from braxy in Iceland. He says that Dr Hjaltelin, writing during the years 1855-56, reported that in one district of Iceland (Sönder Amt) the annual loss for the last five years had been

[1] *Loc. cit.*, pp. 24, 25.
[2] *Loc. cit.*, p. 79.
[3] *Loc. cit.*, p. 52.
[4] *Loc. cit.*, p. 253.

6000 sheep. The veterinary surgeon, S. Jónsson, has given a summation of the loss entailed over all Iceland for the year 1870-71. He says that the disease was pretty equally distributed over the island, and that the loss during that year was 11,317 sheep, exclusive of that occurring in three small districts from which reports could not be obtained, and this loss took place out of a total of about 352,000 in the entire island.

The actual loss in money represented by these figures is enormous, and even if, as Cowan[1] remarks, the hoggs are sent to winter elsewhere, the expense of doing so is so great as to seriously interfere with sheep-farming as a profitable undertaking; while if they are kept at home, not only will a large percentage die and be a direct loss to the owner, but there ensues an irregularity in the numbers and respective ages on the farm detrimental to sheep-farming in its best aspects.

Symptoms.

Under natural circumstances the animal dies so rapidly that opportunity is seldom afforded of studying the disease from its commencement until its termination. All accounts, however, seem to agree that a short, quick step is perhaps the first sign noticeable. The animal is off its feed and is restless, with a tendency to lie down and get up suddenly, as if expressive of a certain uneasiness. Quite likely it is noticed that it does not rise so readily to the dog as others do. When the disease has been conferred experimentally by inoculation upon a hind limb, I have found that the limb invariably hangs down in a paretic condition, the ankle is flexed, and the animal continues to roam about in a half-dazed condition, trailing the inoculated limb after it. The pulse varies between 30 and 35 per minute, and is often imperceptible in the extremities, the breathing is somewhat laboured and from 40 to 42 per minute, while the temperature runs from 105° to 108° F. Rumination is entirely suspended, and a crunching noise is sometimes emitted. The belly usually begins to swell, the back rises, the head is depressed, and the animal roams about in a listless manner, then, probably, if not enclosed, will crawl away from its mates, take refuge in a cranny or nook, and finally falls over on its side. When this stage is reached, my experience leads me to believe that the fatal issue is not far off. Probably within an hour or two the animal is dead. The blood is said to be very dark and thick, and does not flow easily, but I think that undue emphasis has been laid on this as a sympton of the disease. I have known a subject of natural braxy bleed to death into its own stomach.[2] When once the animal falls over it passes into a semi-comatose

[1] *Loc. cit.*, p. 250.

[2] See case No. 3.

state, and makes no further effort to escape. It is often said that it seems to suffer from cramping pain in the abdomen, but my own observation seems to point to the symptoms of uneasiness being due, quite as much at least, to feverishness and to the animal being in a half-delirious state. The swelling of the abdomen is often not at all marked until after death, when it ensues with great rapidity; a matter of a couple of hours being sufficient to render the abdomen tense and tympanitic. When inoculated experimentally, the subcutaneous areolar tissue of the thighs and abdomen can be felt to crackle on pressure at the time of death of the animal, and this also increases rapidly immediately after the animal has died. In some cases there is evidence of diarrhœa,—in fact, from the almost universally empty condition of the bowel after death, I am inclined to believe that diarrhœa, or at least copious evacuation of the bowel, must be of common occurrence. The tail and the neighbourhood of the anus are frequently soiled with moist fæcal matter. The urine is said to be scanty and dark-coloured, but I have not noticed, in cases where there was an absence of hæmorrhage into the muscles or elsewhere, that the urine contained in the bladder after death presented any abnormality. Hogg[1] relates that an animal which he was carrying home on his shoulders vomited, but this must be a rare symptom, as the paunch is invariably filled with food.

The disease usually runs a course of from five to eighteen hours after the symptoms have declared themselves. The most rapid course I have noticed, in a case induced by inoculation, was nineteen hours, dating from the time the virus was introduced up to the fatal termination.[2] Some cases are said to linger for a few days, but I doubt if these are instances of braxy. There is no more constant sign of the disease than the extreme rapidity with which the fatal issue ensues, and in this respect the disease has often reminded me of Asiatic cholera.

The incubation period can only be determined, of course, by inoculation experiments, and I have found it to be generally from forty-eight to sixty hours, but often very much shorter. When the virus is sporing and is injected simultaneously with acetic acid, not only does the attack prove more severe but the incubation period is diminished.[2]

Age of Animals attacked.

Accounts of the disease from all countries seem to uphold the allegation that first year's animals are far more liable to braxy than those more mature. So long as the lamb is following the mother, it is seldom if ever attacked, but after weaning-time it

[1] *Loc. cit.*, p. 52. [2] See case No. 8.

is constantly liable to the malady, and this liability reaches its climax during the late autumn and early winter months. There is some endeavour on the part of flock-masters to show that if the hoggs are not separated from the mothers the disease is less severe than when they are kept in a hirsel by themselves, but the evidence is conflicting. Two-years' animals are seldom attacked in the West Highlands, and three-years' ewes are said to be quite exempt.

The fact of this progressive immunity with age is one of extreme interest, and opens up a field for investigation in the production of artificial immunity. Do the animals in their youth suffer from a mild attack, insufficient to cause noticeable symptoms, but which nevertheless is sufficient to protect them for the rest of their lives? On talking the matter over with shepherds and others, I have always found that they consider this quite likely. Hoggs are often slightly indisposed in the autumn, and they all admit that this may be due to a mild attack of braxy.

Tups do not seem to be attacked with the disease in the West Highlands, although they often suffer and die from a mysterious affection when brought from a distance and put upon fresh pasture. In a typical case of this tup-disease, which I examined both before and after death, there were not the usual signs of braxy, but in the liver there were patches of abscesses very like those associated with pyæmia, and which I found were beset with filariæ. The animal seemed to have died from a septicæmia, taking its origin from this source.

Touching the question of the possibility of an animal in which the symptoms are thoroughly established recovering, opinion seems to differ. Gamgee[1] never saw more than one or two cases in which recovery took place, even under the most approved methods of treatment, and he is doubtful if those in which this favourable termination ensued were cases of true braxy. Neither in the natural disease, nor in instances where I have induced braxy experimentally, have I ever seen other than a fatal termination when the symptoms were thoroughly developed. I have often seen an animal indisposed for a day or two after being inoculated, and recover completely; but the symptoms in such cases never amounted to more than trivial indisposition, characterised by a slight halt in the inoculated limb, elevation of temperature, together with some disinclination to feed. I have little doubt, however, that such animals were suffering from a mild attack of braxy, and in this sense recovery may be said to follow in a certain proportion of cases. In fact there is, in my opinion, evidence to show that practically all sheep in infected districts take the disease, most of them in so mild

[1] Our Domestic Animals, vol. iii. p. 302.

a form as to render its detection difficult, and that possibly the future immunity enjoyed depends upon their having thus suffered.

Period of Advent.

Sporadic cases are said to occur during the summer months, and, from the account of these given me by intelligent shepherds, I have little doubt that they are instances of genuine braxy. The great range of mortality, however, prevails during the late autumn and early winter months. It may commence in September,[1] or be delayed till the first or second week of November —a good deal depending apparently on the advent of frosty weather. It disappears with quite as great irregularity—sometimes by the middle of December, at other times not until the end of February. Personally I have never failed to find plenty of cases all through December and in the first two weeks of January. The same peculiarity of advent and cessation of the disease has been noticed in all countries where braxy prevails.

Post-mortem Appearances.

On no subject connected with the disease is there perhaps more ambiguity than in the interpretation of the appearances of the carcass after death. A good deal of this is due to the evidence we possess being from those unskilled in morbid anatomy, and who have described the effects due to rapid decomposition as of ante-mortem significance. I must say this however, to the credit of shepherds and others in the West Highlands at least, that I have never found them wrong in the diagnosis of a case after death. They are all perfectly acquainted with the appearances the disease produces, although their interpretation of them is necessarily often somewhat crude. Old shepherds, as Hogg wrote,[2] will undertake to diagnose many varieties, according as the post-mortem residua are most evident in the reed or fourth stomach, the intestine, the blood, the flesh, or the liver. He himself said[3] that he had dissected several hundreds of cases in all stages, and that in the whole course of this his experience there had not been above one case in a hundred where it was not evident that the reed was or had been the first and principal part affected. He regarded the affection of the stomach as inflammatory, and said that the inflammation usually commences about the pylorus. He stated that the aliment in the reed becomes parched and dried, while the internal folds and external surface of that viscus are a shapeless mass of extravasated blood and serum! A vast accumulation of serum soon takes place in the abdomen, and

[1] Cowan, *loc. cit.*, p. 22. [2] *Loc. cit.*, p. 64. [3] P. 48.

it is no uncommon thing to find the skin ruptured from the distension of the carcass with gas, and the serum welling out. These and other experiences induced Hogg to believe that there is but one species of "sickness," and at the time of writing he had never seen any reason to alter his opinion.

In the synopsis given by Duncan of several prize-essays on the disease sent in to the Highland Society,[1] he made out the following varieties. One group of cases he denominates "bowel sickness," and another "sickness in the flesh and blood"; and in the first of these groupings he includes a variety where the stomach is the chief seat of lesion, in which the belly is swelled prodigiously, in which the carcass is much discoloured, the bowels distended with gas and pervaded by a general redness, the food in the third stomach hard and dry, and in which the carcass has a strong sulphurous odour. In this variety the animal dies quickly. In the second variety the small intestine, instead of the stomach, is inflamed and mortified; in a third, the urinary bladder is the organ at fault; and in a fourth, the chief feature seems to have been abdominal dropsy.

Under the second variety, he enumerated such cases where, in addition to general redness of the whole stomach and bowels, the flesh of the animal is quite tender and soft, and soon assumes a greenish hue. In this case also the vessels of the brain are red and turgid. A last variety, he affirmed, is located chiefly in the blood, and, in this, the blood tends to decompose and putrify very rapidly, while the flesh, if the animal is bled to death, may be comparatively sound. He said that it is accompanied by pleurisy and diaphragmitis.

The most common variety, according to Robertson,[2] is where the animal becomes much swollen, even before death, and on being cut up emits a strong and offensive odour. Another he terms the "red braxy," so-called from the vessels under the skin being inflamed and giving the carcass the appearance of a mass of putrid flesh. In a third variety, there is no swelling during the progress of the disease, and the noxious gases, which give the peculiar odour in the first form mentioned, are almost entirely absent. He has occasionally seen a hair-ball in the fourth stomach.

Cowan[3] affirmed that the more prominent appearances of organic disease are to be found in the inflamed state of the abdomen, and that the reed or fourth stomach is generally implicated to such an extent as to give rise to the presumption that it is the organ first affected. He describes large mortified spots spread over its surface, which are so fragile that sometimes the finger may be pushed through them, while its inner coating is sometimes entirely black. Next to the stomach, the bowels

[1] *Loc. cit.*, p. 363. [2] *Loc. cit.*, p. 80. [3] *Loc. cit.*, p. 19.

and kidneys are most seriously implicated, the kidneys in severe cases being reduced to a soft pulpy mass.

Nielsen[1] says that the cadaver is much blown out, and the wool so loose that it can be readily torn off. The subcutaneous veins are filled with thick, badly coagulated blood. On opening the abdomen a serous exudate runs out. The organic changes are most marked in the fourth stomach, whose mucosa is to a greater or less extent œdematous and hæmorrhagically infiltrated. The hæmorrhages may affect the whole thickness of the wall, so that they are seen through the serosa as dark-blue patches, and these patches, he remarks, are always regarded by the laity as a most characteristic sign. These pathological changes may also extend over the greater part of the intestine. In many cases these are the only pathological alterations found, in other cases they are simply the precursors of a general infection; and *per contra* there may be a general infection without intestinal lesion. Where a general affection has become established, the appearances are essentially other than the above, and consist of wide-spread parenchymatous degeneration of all the organs, with evident splenic tumour.

I do not know whether Jensen's description[2] is taken from personal observation of animals dying from the disease in infected districts, or is simply a summary of the observations of others, but the following are the chief post-mortem appearances to which he refers. When the animal is killed during an attack the essential change is a dark bluish-red, somewhat swollen patch on the fourth stomach. This patch increases in size, so that towards the end of the attack a great part or the whole of the stomach may be hæmorrhagic or serous-hæmorrhagic. The fourth stomach and adjacent part of the bowel are devoid of food, but sometimes contain a bloody fluid. The hæmorrhagic infiltration may spread from the fourth over the other stomachs, partly over the duodenum, or even over a great portion of the intestine, while other parts of the intestine may be hæmorrhagically injected. In the cavities of the body there may be a little serous fluid. The blood is dark, and may be clotted; and the spleen is occasionally somewhat swollen, but may be quite normal. The liver is pale, brittle, and degenerated, and in extreme cases the friability is probably from post-mortem causes. The kidneys may be normal or somewhat degenerated; not uncommonly, however, they are enlarged and very brittle, or even diffluent. The cadaver decomposes very soon, and before long the hind-quarters become blown up with gas, the verge of the anus protuberant, the skin takes on here and there a bluish colour, and the wool is easily detached; sometimes the

[1] Monatshefte für praktische Thierheilkunde, Bd. viii. Hft. 2, 1896, p. 56.
[2] *Loc. cit.*, p. 254.

skin bursts and a serous-hæmorrhagic fluid is seen oozing from the subcutaneous areolar tissue.

In the case of sheep inoculated with a culture of braxy bacillus, he found [1] that all showed a very marked hæmorrhagic subcutaneous œdema which spread out from the point of inoculation on the inner side of the thigh over the hindqarters and belly. In the musculature of the thigh and leg, partly in the abdominal muscles, there was widespread hæmorrhage, to such an extent that sometimes the muscles were quite black. Emphysema was also very evident in the muscles. Within the abdomen there was a little blood-stained liquid. The spleen, in all cases, was slightly enlarged, the liver yellow and degenerated, and the lungs very œdematous. In one lamb the kidneys were soft and degenerated, while in other two they were almost diffluent, an appearance which he says is characteristic of spontaneous cases. On microscopic examination, great numbers of rods with round ends, and which were sporing, were found in the muscle juices.

Such will give the reader a fair synopsis of the observations, skilled and unskilled, of those who have made a study of the disease, and, as there is some discrepancy noticeable among them, let me next give an account of some typical cases which came under my own observation. The descriptions I give are all from notes taken at the time of making the post-mortem examination, and, as nearly as possible, are in their original form.

The following three cases were all obtained from a farm about six miles from Fort-William. They were part of a lot of hoggs brought down from a neighbouring hill, and at present were being fed on turnips on low ground. Many of them had died from "louping-ill" in the autumn, and the owner showed me one of the animals affected with this, which was lying on its side in a shed and being fed by hand. Of late, however (December 29, 1897), "louping-ill" had almost ceased from among them, but the ravages of "braxy" had been tremendous. The hirsel, when I saw it, was composed of about 100 hoggs which, instead of having been sent away to winter at a distance, had been retained on the farm, and up till shortly before I saw them had been on the neighbouring hill. The loss from "braxy" of late however had been so great that the owner had put them on turnips with the view of saving them, but, if anything, with a more disastrous result than before. He expected, in fact, that every one of them would die, which I believe proved to be very much what happened. Of late, as many as four and six of the lot had been found dead every morning. Yesterday two were noticed to be weakly, and on the morning of my visit

[1] *Loc. cit.*, p. 266.

three were found dead, and another was brought in while I was engaged examining these three. The weather at the time was wet and boisterous.

Case No. 1.

This was a male blackfaced hogg, quite warm at the time of examination, and which could not have been dead more than an hour and a half to two hours, if as much. It was in excellent condition, the owner remarking that it is always those in best condition which are attacked first. There was no evidence of it having suffered from diarrhœa, so far at least as the soiling of the tail might indicate. Decomposition had not commenced, and there was not as yet much blood-staining of the subcutaneous areolar tissue. The abdomen was much distended with gas, and markedly tympanitic; the gas was contained mostly in the peritoneal cavity, only a small quantity in the stomach and intestine. Emphysema was not found in any part of the areolar tissue of the body. The amount of liquid in the peritoneal sac was comparatively small, only about 3 oz., and consisted of blood-stained serum. There was no evidence of congestion of the abdominal blood-vessels, and there was an entire absence of peritonitis.

The *rumen* was filled to distension with what seemed to be excellent food, and with the exception of its epithelium peeling off in flakes, evidently a post-mortem effect of maceration, it was quite healthy. The *second stomach* (reticulum) was also filled with food, and the *third* (psalterium) was so packed with food that it felt like a cricket-ball; but both of these were free from organic disease. The food in them was dry, and crumbled on pressure between the fingers and thumb. In the psalterium it was firmly implanted within the plicæ.

The *fourth stomach*, however, was distinctly abnormal. It was destitute of food, but contained about 2 oz. of a brownish-red, grumous, or gruel-like liquid, which seemed to be a mixture of blood and mucous secretion. Certain parts of the mucous membrane were infiltrated, thick, and velvet-like, and showed punctiform hæmorrhages. Their colour was brownish-red, as if from blood-infiltration altered by the secretion of the stomach. There was undoubted congestion of the mucosa, but it was not extreme. The outside of this stomach was blood-stained but not congested, nor was there any evidence of localised peritonitis over the affected areas of mucous membrane.

With exception of a minute punctiform injection of the mucous membrane here and there, the *intestine* was free from evidence of disease. It contained some gas, but no fæcal matter or anything else. The substance of the *liver* was riddled with small cavities containing gas, more numerous in some parts than in others. The affected portions had quite a sponge-like feeling. At one point there was a wedge-shaped collection of small abscess-like areas which on microscopic examination proved to be filarious. The *spleen* was healthy, but the *kidneys* were very soft and friable, while the capsule peeled off on the slightest traction. Hydatid cysts were found adherent to the peritoneum here and there, but otherwise the abdomen was healthy. The *lungs* were much congested in parts, and contained half-solid wedge-shaped areas which proved to be filarious. There was a total absence of pleurisy. On piercing the heart, gas escaped from it in a whiff. The chambers all contained blood in a firmly coagulated state.

The viscera, as in all other cases, had a most remarkable and characteristic odour. It is not that of ordinary putrefaction. In this case putrefaction had not commenced, and still the odour was quite characteristic. Sometimes it reminds one of sour beer, but is more usually

approximated by that of stale fish, or decomposing urine. It is a most important diagnostic sign after death.

Case No. 2.

A male blackfaced hogg from the same hirsel as that from which case No. 1 was obtained. It was found dead this morning (December 28, 1897), and at the time of examination was quite warm; it had died evidently only quite a short time since. The carcass was in good condition, and there was no *rigor mortis*, nor were there signs of putrefaction. It did not seem to have suffered from diarrhœa.

The abdomen was tympanitic and distended with gas, and the gas was mostly contained in the peritoneal cavity, although there was also a little in the intestine. About 2 oz. of blood-stained serum, without any flakes of lymph in it, were contained in the peritoneal cavity. The abdominal vessels were not unusually turgid, and there was an entire absence of signs of peritonitis.

The *rumen* was distended with what appeared to be excellent fodder, but its epithelium was being detached in large flakes. The *second* and *third stomachs* were free from disease, except in so far as the third was so packed with hard food that it cut like a bird's gizzard, and it contained a wool-ball, black externally, the size of a walnut.

The *fourth stomach* did not contain food, but in its place a little brownish-red liquid, as in the foregoing case. The mucous membrane was somewhat rugose, and on the folds, here and there, there were the same blood-infiltrated patches as in case No. 1, but less evident. The *intestine* was healthy and empty. The *spleen* was also healthy, and the *liver*, with the exception of its being sponge-like from gas development, was free from disease. The *abdomen* presented nothing abnormal; there was a complete absence of any indication of peritonitis. The *lungs* were deeply congested in parts, and these were somewhat collapsed. They did not present any further abnormality, however, unless that here and there wedge-shaped patches were seen, paler than their surroundings. The pleural cavities contained a little blood-stained serum, but the pleuræ, like the peritoneum, were free from any sign of inflammation. A whiff of gas escaped on opening the *heart*. The heart's blood was firmly coagulated and all the cavities were moderately distended.

Case No. 3.

A blackfaced ewe-hogg, in splendid condition, taken from the same hirsel as cases 1 and 2. It had just died when the examination was made; an hour previously it was seen alive and walking about, although feeble. The carcass was quite warm, and peculiarly blanched. There was no more subcutaneous emphysema than might have been produced accidentally in flaying the animal. From the vessels in the neck, what blood was contained in them ran freely enough. The abdomen was distended with gas, and contained only about 1 oz. of serum, which was not blood-stained. It was free from flakes of fibrin; there was no evidence of peritonitis nor of vascular distension of the abdominal vessels, indeed rather an appearance of anæmia.

The *rumen* was full of good herbage and other food (turnip), well masticated. The epithelium had not stripped off as in other cases, but this is the only instance in which I have found this appearance fail. The *second* and *third stomachs* were also full of food, that in the third being impacted within the plicæ. A wool-ball was found in the third stomach, but otherwise all these organs were perfectly sound.

The *fourth stomach* and the upper third of the duodenum, however,

presented a remarkable appearance. As they lay *in situ* they resembled a huge blue sausage, an appearance amply accounted for on cutting into them. Their interiors were filled with coagulated and deeply venous-coloured blood, quite recently effused. They were devoid of food. The mucous membrane of this stomach was infiltrated here and there as in cases 1 and 2, but not to such an extent. The effused blood had evidently come from an over-distended blood-vessel, but the actual point of rupture could not be ascertained. The vessels of the stomach generally, and those of the abdomen, had apparently emptied themselves into the fourth stomach, and at the time of examination were unusually free from blood. The *small intestine* was in great part empty, but *the large* contained a good deal of fæcal matter in its transverse part. The rectum was empty.

The *spleen* and *kidneys* did not appear to be much altered, and the *liver* was sound and did not present the sponge-like aspect and consistence of many other cases. The *abdomen* was free from disease. The *lungs* presented a pale greyish-yellow tint, from being almost completely anæmic. They contained a few filarial nodules, but no further abnormality was noted within them nor on their surfaces. The *heart* contained a little gas; its chambers were almost bloodless, but the organ otherwise was healthy.

Case No. 4.

The subject of this examination was a male blackfaced hogg reared on a farm near Corpach. The farmer had noticed yesterday that it was dull, and did not rise to the dog so readily as did the others of the same hirsel. It was found dead the day on which the post-mortem examination was made, and had died probably in the morning. The carcass was examined at noon, and was cold. It was in good condition. The subcutaneous areolar tissue over the breast was blood-stained, and the abdomen was distended with gas and of a slightly greenish colour from incipient decomposition. On opening the abdomen some gas escaped, and abundance of slightly blood-stained serum with a few flakes of fibrin in it. Altogether, the liquid came up to about 10 oz.

The vessels of the omentum were engorged with blood, but there was no injection of the serous coat of the stomach nor of that of the intestine. There was no evidence of peritonitis, and the liquid in the abdomen did not partake of the characters of an inflammatory effusion. The epithelium of the *rumen* was peeling off, but with exception of this, which, as before remarked, is probably a post-mortem effect, the *first*, *second*, and *third stomachs* were free from visible evidence of disease. They were filled with fodder which did not present any abnormality.

The mucosa and contents of the *fourth stomach*, however, were somewhat altered. The rugæ, here and there, had a deep purple-brown colour and an infiltrated, soft, velvety appearance. The epithelium seemed to have been shed in part, but there was no ulceration of the surface. The contents were a brownish-red thick liquid, about 4 oz. in amount, of grumous consistence, and without any show of herbage.

The omental fat was slightly stained with bile opposite the gall-bladder, and a few hydatid cysts were found attached to the membrane. The *liver* seemed healthy enough on the surface, with exception of a round greyish-coloured patch about half an inch in diameter. The cut surface of this patch presented some yellowish half-necrotic points, and the area in which these were contained was wedge-shaped. It proved to be of filarious origin. The *lungs* were somewhat fully congested, but there was no sign of pleurisy, nor was there any serum in the pleural cavities. The lungs, however, showed some filarious patches. The bronchi contained a little mucus, but were otherwise normal. The *blood* in the heart was pretty

firmly coagulated. The *kidneys*, *heart*, and *spleen* did not appear to be much altered.

The odour of this carcass, as in the case of all the others described, was quite characteristic and very powerful; it adhered to my hands and instruments over-night, even after copious washing and disinfection with corrosive sublimate.

Case No. 5.

The animal in this case also came from a farm in the neighbourhood of Corpach. It had been dead for probably eighteen hours at the time of the autopsy, the weather meanwhile being bitterly cold. The carcass was cold, and the skin of the posterior part of the abdomen was faintly greenish-coloured. The abdomen was tightly distended, and on being opened emitted much gas with the peculiar braxy odour. The viscera, however, did not seem to be in a state of ordinary putrefaction; they were, on the contrary, remarkably fresh. There was pronounced blood-staining along with slight subcutaneous œdema of the sides of the chest, axillæ, and groins. The abdominal cavity contained about 15 oz. of slightly blood-stained and somewhat opaque serum, with a few flakes of fibrin in it.

The large veins over the various stomachs were filled with blood, especially in the case of those over the fourth stomach. The *first*, *second*, and *third stomachs* were packed with herbage, which was hard and extremely dry and compact, while the epithelium was peeling off the mucosa of the first. The *fourth stomach* contained about ½ oz. of brownish-red slimy liquid, with particles of sand in it. At one point, there was a rounded coin-like elevation of the mucous membrane about the size of a florin, without redness of its surface or of its surroundings. It looked like a chronic condition, unconnected with the disease. The mucosa was free from congestion, hæmorrhage, and ulceration. It seemed, however, if anything, to be a little more blood-stained than usual.

The *liver* was fawn-coloured, and had a sponge-like consistence, from the development of gas within it. The *spleen* was soft but otherwise unaltered; the *kidneys* were soft, and the capsule stripped off with unusual ease. The *right lung* was congested in patches, but was free from any indication of pleurisy.

Case No. 6.

The carcass in this case was that of a blackfaced ewe-hogg, which also came from a farm in the neighbourhood of Corpach. It was said to have died two days previously, but appeared to be, as yet, remarkably fresh, probably from the weather having been piercingly cold and dry. The abdomen was distended and tympanitic, but not to an extreme degree. When opened, a whiff of gas escaped from it, but the tympanitis was also occasioned by gas contained in the intestine. In parts, and more particularly over the abdomen, the subcutaneous areolar tissue was slightly green-coloured from commencing decomposition. It was also œdematous here and there, especially above the symphysis pubis and in the groins. The abdomen contained from 6 to 8 oz. of faintly blood-stained serous liquid, with a few flakes of fibrin in it. The blood within the *heart*, which was firmly coagulated, fairly well distended the heart chambers, while the heart-walls were rigid.

The *first*, *second*, and *third stomachs* were engorged with food, the rumen intensely so, and that within the psalterium was firmly impacted within its folds, this division of the stomach emitting a dull, board-like ring when struck. The epithelium of the psalterium was peeling off in flakes. The *fourth stomach* was empty, and the vessels on its outer aspect were somewhat hyperæmic. I could not detect any congestion of the mucosa,

nothing more than what might have been accidentally present. Nor did it show any signs of ulceration. Both the mucosa and submucosa, however, seemed to be thickened in parts, and numbers of gas cysts (aërocystides), varying in size from a lentil to a large pea, were seen upon its mucous surface, evidently due to accumulation of gas beneath.

When the *liver* was cut into some gas escaped from its large vessels, but otherwise the organ did not appear to be abnormal. The *kidneys* and *spleen* were extremely soft and disintegrated. The carcass, otherwise, was free from any sign of disease.

In all these cases, the bacillus of braxy was found widely spread abroad in the tissues and liquids of the body. The peritoneal liquid invariably swarmed with it, and it was also present in great abundance in that of the pleural cavities and subcutaneous areolar tissue. In the organs found altered after death, and which were examined microscopically, it was in great quantity. The blood contained it in varying amount, and I question if it is ever free from it. It seems to grow best, however, under natural conditions, in the various serous effusions, and particularly well in the peritoneal liquid. Numerous cultures were made from the peritoneal and other liquids derived from the above cases. They were inoculated successfully on fresh animals.

On microscopic examination of the fourth stomach, where diseased, I have always found the infiltrated patches to be free from any inflammatory indications. The vessels of the submucosa are distended with blood, and minute blood-extravasations are present in the mucosa itself, but there is no effusion which can be termed inflammatory. The surface of the mucosa is necrotic, and most of the sloughy half-detached material evidently becomes digested off. Those stomachs which I examined were removed with the greatest care, the morbid parts being cut off without being washed, and immediately put into methylated spirit. They were subsequently imbedded in celloidin before being cut, so as to fix the parts exactly as they were at the time of death. The epithelium was always found to be destroyed by auto-digestion, while the necrosis of the surface extended into the glandular structure of the mucosa for perhaps a fourth of the thickness of the entire membrane. The blood-corpuscles in the minute hæmorrhages above described were always in a state of dissolution, their presence being indicated by brownish pigment. The substance of the mucosa was swarming with the characteristic bacillus, sometimes extending into the submucosa and its blood-vessels.

Summary of the Six Cases.

In summarising the features of the six typical cases just related, identified, as they were, not only by the ordinary post-

mortem naked-eye features of the disease, but by the recognition of the specific bacillus, and, in several instances, its successful culture and inoculation, I find them to be as follows:—

1. The absence of any external manifestation of the disease, as in the case of the slough of quarter-evil.
2. The tendency which there is, both during life and after death, to the production of gas.
3. The presence of sero-sanguinolent effusions into the various cavities of the body and into the subcutaneous areolar tissue.
4. The tendency to blood-staining of the tissues.
5. The absence of inflammatory manifestations.
6. The occasional, but by no means invariable, hæmorrhagic infiltration of the mucous membrane of the fourth stomach, with, from time to time, ulceration or digestion of the surface of the infiltrated parts.
7. The distension with food of the first three stomachs, and the absence of food in the fourth or true stomach, and usually in the intestine. The presence of a little brownish-red grumous liquid in the fourth stomach.
8. The occurrence, occasionally, of hyperæmia of the large vessels in the walls of this organ, accompanied by blood-staining of the surrounding tissues.
9. The absence of extensive hæmorrhage into the musculature of the body; the absence of gas-production in the muscles.
10. The invariable presence of the braxy bacillus in the liquids, tissues, and organs of the body.

Any other post-mortem appearances may be, and probably are, mere epi-phenomena: such for instance as the copious and fatal hæmorrhage into the fourth stomach mentioned in case No. 3. It is quite likely that the meaning of the distension of the paunch, and not uncommonly of the second and third stomachs as well, is that the disease seizes the animal suddenly while rumination is proceeding. The fourth stomach and small intestine seem to empty themselves during the course of the disease; they are both usually found empty.

The lesion found in the fourth stomach has generally been described as inflammatory, and the name given to the malady by Nielsen, of "Gastromycosis ovis," would point to the stomach being looked upon as its head-centre. With the exception of Gamgee,[1] authors invariably speak about the disease as being inflammatory—a hæmorrhagic inflammation. Gamgee, however, denied that it is an inflammatory disorder. The extensive ecchymoses, he remarked, have been regarded as inflammatory lesions; any redness has been ascribed to inflammation, but

[1] *Loc. cit.*, p. 293.

very erroneously. With this I am inclined to agree. The blood-corpuscles tend to undergo hæmolysis in large numbers, the pigment escapes from them and stains the serum effused into the body-cavities and subcutaneous areolar tissue; and this blood-staining has been mistaken, as Gamgee remarked, for evidence of inflammation. My firm conviction is that the braxy organism is not productive of inflammatory change. I have never once seen evidence of peritonitis, pleurisy, or pericarditis in any case, natural or experimental, although the serous liquid which had accumulated in the respective cavities was simply teeming with the bacillus. Even in cases where the virus had been inoculated experimentally into the thigh, and where the thigh muscles were so hæmorrhagic as to present the appearance of a black mass when cut into, I have found the lesions to be indicative of blood-extravasation rather than of acute inflammation. Thus blood is poured out between the bundles of muscular fibre, and finding its way into the lymphatics, injects these. It coagulates, and the fibrin, with entangled blood-corpuscles, is seen filling up their channels. The corpuscles break down, and their remains can sometimes be noticed lying in the distended lymphatics as a granular detritus. There is not the slightest tendency, however, in such muscles to the exodus from the blood-vessels of leucocytes, nor do the surrounding fixed tissues exhibit any inflammatory reaction. The hæmorrhage, under such circumstances, does not seem to be any more inflammatory in its nature than that into the spleen which accompanies anthrax. Even the lesion of the stomach, the tumefaction of its mucous and submucous coats with punctiform extravasation of blood, as just noticed, does not seem to be of an inflammatory nature. The patch of redness seen on the outside of the organ is, in my opinion, due to blood-staining. I have never seen any lymph on the serous coat to indicate that this redness represented the congestion of a localised peritonitis. Yet the notion that the fourth stomach is the chief seat of the disease has got such a wide hold upon the minds of those who have written upon braxy, that this blood-staining and occasional hæmorrhagic tumefaction of the mucosa are looked upon as quite diagnostic. So prevalent, indeed, is this notion that, according to Jensen,[1] the disease is known in certain parts of Iceland as "vinstrarfár" or "vinstrarplága," that is to say, "stomach-ill" or "stomach-sickness."

All the appearances described point to braxy being a parasitical disease of a specific character. The organism tends to grow in the blood and in the serous effusions found in various parts of the body, to form gas in these, and most likely to cause the death of the animal by the formation of poisonous toxines.

[1] *Loc. cit.*, p. 253.

Post-mortem Appearances in Experimental Cases.

It may be interesting to compare the post-mortem appearances presented by the carcasses of sheep dying from braxy experimentally conferred with those of the natural disease, and, accordingly, I relate the following which I consider to be typical:—

Case No. 7.

About 3 c.c. of peritoneal liquid taken from case No. 6 were mixed with 30 c.c. of neutral peptone beef-tea, and $1\frac{1}{2}$ c.c. of this mixed liquid was injected subcutaneously into the inner aspect of the right thigh of a blackfaced male hogg. The hogg was from the same farm, near Corpach, from which case No. 6 had been procured. After inoculation it was put into an enclosed field, and the following day was noticed to be somewhat lame in the inoculated leg. In about forty-eight hours after the operation the condition of the animal had altered materially for the worse. The inoculated leg hung down in a listless half-paralysed condition; the whole appearance of the animal was dull, and pointed to its being in a stupefied condition. It roamed about the field apart from its mates, with downcast head, and frequently lay down for a few minutes, rose up restlessly, and recommenced the same wandering progress. It seemed to be entirely off its feed. The following morning it was found dead. The shepherd said it died during the night or early morning, as it was alive when he saw it the previous evening. The whole time which elapsed between the time of inoculation and death could not have been more than sixty hours.

The examination was made an hour or two after it was found dead. The subcutaneous areolar tissue of the inoculated leg and of the lower part of the abdomen crackled from the gas developed within it. There was no evidence of abscess or any outward sign of the disease, and the wool was not becoming detached. The tongue was protruding from the mouth, and frothy blood-stained liquid was exuding from the nostrils. The body was still warm, and the abdomen was swollen and tympanitic. The shepherd who removed the fleece acknowledged, although he was opposed to the inoculability of braxy, that he had never seen a more typical case.

The subcutaneous areolar tissue, with exception of that of the left side of the neck, abdomen, and breast, was much blood-stained, and became of a bright scarlet colour on exposure to the atmosphere. Much gas and œdematous liquid were contained within its meshes, more particularly over the thighs and posterior half of the abdomen. There was no abscess or other deep and local sign to indicate the point of inoculation, nor were there extravasations of blood into the inoculated limb or into the muscles elsewhere. The blood-staining of the right side of the body was much more evident than that of the left, probably from the animal having lain on that side at the time of death. There was no evidence of decomposition; the weather was cool at the time, although the frost which had prevailed for a day or two previously had disappeared. The carcass was in excellent condition.

The somewhat fish-like or urinous odour was very pronounced. The reaction of the peritoneal liquid and blood was acid, a feature of the disease I have found to be not uncommon. The abdomen contained from 6 to 8 oz. of deeply blood-stained serous liquid, almost free from flakes of fibrin, but slightly turbid. The abdominal cavity was distended with gas, and there was no sign of peritonitis. The *liver* contained a good deal

of gas, which caused the blood in the large vessels to froth when the organ was incised. The right pleural sac contained about 4 oz. of deeply blood-stained serum, the left about 1 oz. of the same. The *right lung* was much congested, and punctiform hæmorrhages were scattered abundantly over its surface.

The *rumen* was filled with moist herbage, and the *psalterium* was packed with the same, but of firmer consistence. The first three stomachs were free from organic disease, with exception of the epithelium peeling off from their surfaces in huge flakes.

The *fourth stomach* was empty, and on its mucous membrane, more particularly towards its pyloric end, there were numbers of necrotic areas, in size from a lentil to a three-penny-piece. They were perfectly black and without much, if any, congestion round about them. They looked like, as I think they undoubtedly were, incipient gangrenous sloughs. They did not pass through the entire thickness of the wall of the stomach, but were confined to the mucosa. They were invisible from the outside, and there were no localised patches of peritonitic effusion on the serosa to indicate their presence and position. There were altogether from ten to twelve of these, and all confined to the pyloric half of the organ. The blood-vessels on the exterior of the stomach were not unusually congested. The blood taken from the heart and large vessels was thin, poorly coloured, and watery; it was, indeed, hardly deeper-tinted than the peritoneal serum. A small hydatid was found attached to the peritoneum, but otherwise the carcass was quite sound.

Microscopic preparations, in the fresh state, and after staining, were made forthwith of the peritoneal, pleural, and subcutaneous-areolar-tissue liquids, and of the blood. All of them, and especially the peritoneal liquid and blood, contained the braxy organism in great abundance, and apparently unassociated with other organisms. The organism was quite motionless, round at the ends, and in most instances showed a spore at one end, so that it presented a characteristic drumstick appearance, like that of tetanus. The bacillus stained deeply with Gram's method, while the spore remained uncoloured. With the fuchsin and methylene-blue process of double-staining, the spore coloured red, the body of the bacillus blue.

Anærobic cultures were made of it in various media, and they grew at a temperature of 37° C. rapidly, with much effusion of gas.

Case No. 8.

Some of the peritoneal liquid from case No. 7 was much diluted with neutral beef-tea, and 3 c.c. of this were injected into the right thigh of a blackfaced hogg, while the same quantity of acetic acid (Phar. Brit.) was injected into the opposite thigh.

On the following morning the animal was found ill, limping in the right limb, and listless. By 11 A.M. it was worse, and by noon had fallen over on its side. It did not appear to be suffering pain, but was in a state of intense collapse. By 12.30 P.M. it was dead, exactly nineteen hours after being inoculated. For some time before death the tissues in the groins crackled from emphysema, and the animal's abdomen was fairly distended with gas, and tympanitic.

The post-mortem examination was made at 5 P.M. of the day of death. The body was still warm, and the abdomen was distended with gas to a greater extent than at the time of death; the emphysema of the groins was also more evident. The tongue was forced out of the mouth by the distension of the carcass, and from the mouth blood-stained liquid was running. The verge of the anus was prominent from the same cause.

The *paunch* was blown up with gas, but the intestine only moderately

so. The most of the gas, however, was contained in the peritoneal cavity. The first and third stomachs were filled with food, but the fourth stomach and intestine were empty, and there were signs, in the moist and soiled condition of the tail, of the animal having suffered from diarrhœa. There was about half-a-pint of blood-stained serum in the peritoneal cavity, but no evidence of peritonitis. The fourth stomach and other parts of the alimentary canal were free from organic lesion. The pleural cavities both contained blood-stained serum, but there was a complete absence of indications pointing to pleurisy or pneumonia.

On the flexor aspects of both thighs, and equally so on both sides, the muscles were densely infiltrated with blood opposite the points of injection of the acetic acid and the organism respectively, and much blood-stained serum escaped from them when incised.

All the liquids, as well as the heart's blood, literally swarmed with the braxy organism, actively sporing, and mostly of the drumstick form. The blood in the hæmorrhagic muscles had made its way into the lymphatics, and within it, as well as in the intermuscular spaces, there were innumerable braxy bacilli, but the parts were perfectly free from any inflammatory change.

Case No. 9.

An anærobic culture of the peritoneal liquid from case No. 7 was made in glucose beef-tea. It grew luxuriantly, with much evolution of gas, and showed the characteristic rods, a large number of them with a spore at one end. After forty-eight hours' growth 1 c.c. of this culture was injected into the right thigh of a blackfaced female hogg. On the following day it was noticed to be slightly lame in the limb operated on, and next morning it was found dead, something like thirty-six hours having elapsed from the time of inoculation up to the fatal issue.

The post-mortem examination was made on the afternoon of the day of death. There had been a hard frost during the whole time of the experiment, with snow on the ground, but, notwithstanding this, the carcass was still warm when examined.

Blood-stained froth was exuding copiously from the nostrils, and the limbs were only slightly rigid. The inner aspects of both hind-limbs were extremely emphysematous, the emphysema extending over the posterior half of the abdomen. The fore-limbs and other parts of the body, however, were free from emphysema. The wool over the emphysematous area of the right thigh came off in handfuls on the slightest traction, carrying with it the scarf-skin. The underlying skin had a deep purplish-red colour, and was moist and shining.

On removing the fleece, the inoculated thigh, and in fact the entire leg, was seen to be much blood-stained, and on cutting into it the muscles were found to be almost black from hæmorrhage, and quite sponge-like from gas developed within them. They were not œdematous, but, on the contrary, remarkably dry. The subcutaneous areolar tissue over the hæmorrhagic muscles, however, was distended with much blood-stained serous liquid. The opposite thigh and posterior half of the abdomen showed the same blood-stained œdema of the subcutaneous areolar tissue, but the muscles were neither hæmorrhagic nor emphysematous.

The abdomen was fairly distended with gas, partly within the cavity, partly in the alimentary canal. It contained about 3 oz. of deeply blood-stained serum. The *rumen* was filled with moist food, and the epithelium was peeling off from its mucous coat. A patch of blood-staining was found on its anterior aspect, but otherwise it was healthy. The *second* and *third stomachs* had some rather dry food within them, but were free from disease. The *fourth stomach* was practically empty; it did not even contain the usual blood-stained liquid. On two or three of the folds of

the mucosa there was slight punctiform redness, but otherwise the organ was unaltered. The *spleen* and *liver* were somewhat emphysematous. The *kidneys* were almost diffluent, and the capsules had separated from their surfaces from the development of gas underneath. The substance of the organs was pale brownish-pink in colour, and the division between the cortex and medulla was almost imperceptible. The *bladder*, as in all cases I have examined, was quite healthy. The *small intestine* was empty and perfectly sound; the *large intestine* contained a little half-liquid fæcal matter. The right pleural cavity (the animal lay on its right side) contained quite 6 oz. of deeply blood-stained serum, while there were about 4 oz. of the same in the left. The lungs were normal. There was an entire absence of pleurisy, peritonitis, or other sign of inflammation in any part of the body.

On microscopic examination, all the effused liquids and the blood were found to be teeming with the braxy bacillus in the sporing stage. The peritoneal liquid was richest in the organism, but it literally swarmed in all the others, and in the blood. Most of the spores were contained in rods, but some of them were found lying free. Nearly every rod showed a spore, and frequently the spores were very large and took on an elongated-oval form. I think that I have never seen a case in which the sporing stage was so much in evidence. The braxy organism, moreover, seemed to be present in the form of a pure culture.

It will be perceived that the post-mortem appearances found in these experimental cases corresponded essentially with those of the natural disease. There is the never-failing gas production and subcutaneous œdema, the serous effusion into the various cavities of the body, the distension of the first three stomachs, the empty state of the fourth, and, usually, of most of the intestine. The occasional presence of hæmorrhagic infiltration of the mucosa of the fourth stomach with, it may be, ulceration or gangrene of the affected part, together with the presence of the braxy bacillus in the effused liquids, the blood, and the tissues.

The only points of difference I have been able to perceive in the experimental cases, where the disease has been induced by subcutaneous inoculation, as compared with those which were spontaneous, are the presence of considerably more local emphysema and œdema in the vicinity of the point of introduction of the virus, and also the tendency to extreme hæmorrhagic infiltration of the muscles opposite the point of inoculation. In both cases, that of the natural disease and that induced experimentally, there is an entire absence of phenomena which might be termed inflammatory, but there is a decided tendency to destruction of coloured blood-corpuscles, the setting free of their pigment, and the staining therewith of the surrounding tissues.

The Organism.

The merit of having thrown the first light upon the ætiology of the disease is due to Ivar Nielsen. In his work on the

subject,[1] published in the year 1888, he described an organism which he found in the hæmorrhagic areas of the digestive tract, as well as in the capillaries of the various organs, which is, without doubt, the essential factor in the disease. The organism in question is a rod from 2 to 6 μ. long or longer, and about 1 μ. in breadth, with rounded ends (fig. 99). I have sometimes found it, in cultures at least, elongating into a thread, but, in the tissues, it usually takes the rod form. It retains the stain by Gram's method, and more readily when quite freshly removed from the body; it is perfectly immobile, both when taken immediately from the various serous effusions or the blood and

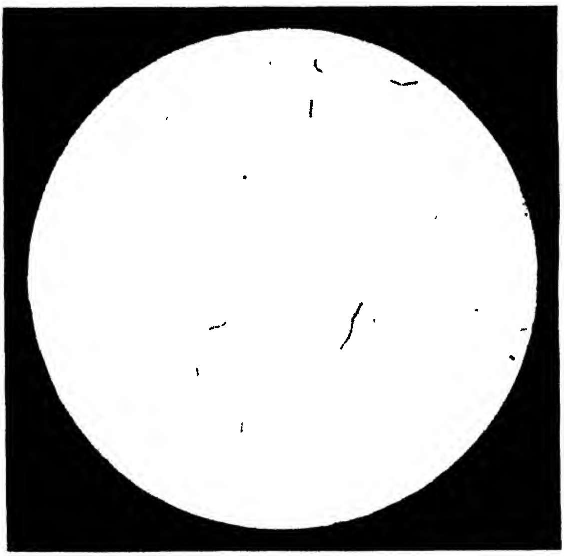

Fig. 99.—*Braxy-bacillus in the non-sporing condition.* $\frac{1}{12}$ oil immersion.

when in culture. As it occurs in the various liquids of the animal, it has a great tendency to spore, often nearly every rod being in this condition. The spore is usually placed at one end of the rod, and when developing gives to this end merely an appearance of being thicker than the other, while, with careful focussing, a clear, minute, and highly refractile point may be detected in the midst of the tuberosity. As the spore enlarges it becomes more and more refractile, and takes on an elongated oval shape, and in this stage the organism has a characteristic drumstick appearance very like that of tetanus (fig. 100). Sometimes the spore is located in the middle of the rod, and

[1] Bradsot hos Faret (Gastromycosis ovis) Tidsskrift for Veterinaerer, 1888.

I have seen, occasionally, a couple of spores of large size in a single bacillus, one at each end. The individual bacilli may be either united at an angle when in juxtaposition, or their axes may lie parallel and in line, in which case they may resemble a single bacillus of unusually great length. Exceptionally they may hang in rows, but this is not common. In certain instances of the disease the spores are present only in small number, or may even be absent, and in such cases the virus appears to confer a mild attack. At any rate, I have often found difficulty in inoculating the disease and producing a fatal issue when the organism is in this non-sporing condition.

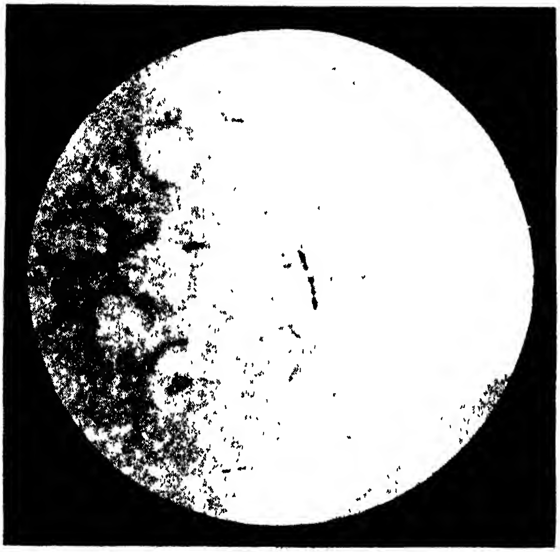

Fig. 100.—*Braxy-bacillus in sporing condition.* $\frac{1}{12}$ oil immersion.

It seems to be a strict anærobe, at least when first removed from its natural habitat. It is extremely difficult to isolate by means of plate cultures if there be the slightest trace of oxygen in the surrounding atmosphere. The method which, in my hands, has proved most successful, is the following: Take the virus from a case in which the organism is sporing profusely. Use a medium composed of peptonised beef-tea with 2 per cent glucose, and be careful that the medium has a faint, but a quite decided, *acid* reaction to litmus. Boil the medium for half an hour before inoculating it, and while it is boiling, or as soon as possible afterwards, inoculate it with a couple of öseful of some of the serous effusions of the body, preferably the peritoneal

liquid. The chief organism of contamination is *Bacillus coli*, and I have never failed to kill this off by the high temperature of the medium. Close the mouth of the tube immediately thereafter with a well-fitting caoutchouc cap, and keep the medium at a temperature of 37° C. I prefer this to all the methods of anærobic culture I have used for isolating the organism. Within a few hours gas begins to be given off copiously, which escapes between the cap and the side of the tube, while the cap contracting makes an excellent valve. At the end of forty-eight hours gas formation has ceased, and the organism falls down, in the shape of a fine greyish-coloured precipitate, to the bottom of the tube, or, if the tube has been in a sloping position, adheres to the lowest side. It seems to grow comparatively little after the time when gas ceases to be evolved, and from this time onwards will generally be found to be sporing.

Other media can be employed for its culture, but in none of them, it seems to me, is the appearance of the growth so characteristic as in the above. Thus it will grow in agar or serum-agar readily enough, the growth in agar being, however, slower than in other media. The addition of 2 per cent glucose to any of these media increases their usefulness. Gelatine is not a favourable medium, although the organism will grow in it. In some of the accounts I have read of the cultivation of the organism in this medium the virus appeared to have been contaminated with *Bacillus coli*.

Where inoculated pure on glucose-agar a luxuriant growth rapidly shows itself along the track of the needle up to within 1 to 1½ ctm. from the surface. There is never a particle of growth on the free surface if the atmosphere within the tube contains oxygen. Copious gas-bells are given off, which soon tear the medium in pieces and force it up against the cotton-wool plug. If the disengagement of gas is slight, mere slits or tiny rents may be formed in the medium, along which the bacillus tends to propagate.

For inoculation purposes, I find the organism taken from the peritoneal liquid the best to work with, grown in glucose beef-tea as above described. By the end of forty-eight hours the growth is in the best condition for inoculating. At a later period, and in proportion apparently with the time, the virulence of the organism becomes less and less; but a good deal seems, as with other bacteria, to depend upon whether it is sporing or not. The spores are peculiarly tenacious of life. Thus Jensen[1] found that after the stomach of a braxy sheep had been kept in dilute spirit, even for a period of seven weeks, he was still able to get a growth from it.

The organism of braxy is apparently very closely related to

[1] *Loc. cit.*, p. 265.

that of quarter-evil and of malignant œdema. The three form a group which stand isolated, and which have intimate mutual relationships. In fact, when growing in solid media there is much difficulty in distinguishing them. Its complete immobility seems to me one of the best features by which the braxy bacillus can be distinguished from the other two. According to Jensen, the braxy bacillus is also to be distinguished from that of quarter-evil by the fact that it is pathogenic to mice, pigeons, fowls, and pigs, animals which are insusceptible to quarter-evil. It is a remarkable fact, however, that these animals never take the disease naturally, nor has the disease ever been known to affect the cow, the dog, or man. I have seen dogs and fowls eating raw braxy flesh over and over again, but even after the strictest inquiry, I have never been able to make out that these animals contract the disease by doing so, nor under any other circumstances. The sheep seems to be the only animal which is naturally subject to it.

Immunity of certain Sheep.

From the partial distribution of the malady it would seem that there must be something peculiar either in the virulence of the bacillus in different districts, or in the susceptibility of the sheep reared upon them. Aberdeenshire and Forfarshire enjoy such immunity that they are the great wintering-grounds of hoggs from the West Highlands. Native sheep in Iceland, the Faroes, and Shetland seem to be much less liable to the disease than those which are imported. If sheep of a breed naturally susceptible are brought from a distance and pastured on braxy land they almost invariably fall victims to the disease in large numbers. There are some curious exceptions to this rule, however, and none more so than in the case of sheep reared in Aberdeenshire.

At the commencement of this inquiry I brought home with me time after time blood, serous liquid, and organs from typical cases of the disease met with in the West Highlands. These were inoculated subcutaneously forthwith on Aberdeenshire hoggs, but always without positive result. Cultures were made from them and inoculated in the same way, but still with the same negative effect. Through the kindness of Dr Malm, Director of the Civil Veterinary Institute in Christiania, I obtained some powder of a desiccated liver from a braxy sheep which died in Iceland, together with œdema liquid and blood from a sheep inoculated with Norwegian braxy, and which died from it. These were inoculated into Aberdeenshire hoggs, but still without conferring the disease upon them or causing much constitutional disturbance. The

animals employed, it may be mentioned, came from near the coast close by Aberdeen.

Under these circumstances I began to suspect that there was something peculiar about Aberdeenshire sheep which rendered them less susceptible to braxy than those reared on the West coast. The animals I employed were at first blackfaces, but I tried the experiment with a Cheviot and a cross without conferring the disease upon them. I resolved, therefore, to make my next experiments in the West Highlands in order to test the above suspicion.

In the month of January, accordingly, I inoculated a West Highland blackfaced hogg, in the neighbourhood of Corpach, with peritoneal liquid taken from an animal just dead of the disease. The animal inoculated died from typical braxy in the specified time, with emphysema and hæmorrhage spreading up over the limb and posterior part of the body, from the point of inoculation. The same virus taken home and inoculated on an Aberdeenshire hogg proved negative.

In January of the year 1901 I took six blackfaced Aberdeenshire hoggs up to Corpach, and placed them on ground notorious for braxy. The farmers in the neighbourhood told me that before long they probably would all die from the disease; such an unheard-of proceeding was to their minds practically certain to have only one result, and that a fatal one. An animal happened to die from braxy on the farm where they were pastured, a few days after their arrival, and I obtained a quantity of peritoneal liquid from its abdomen. The following day 3 c.c. of this liquid were mixed with 30 c.c. of neutral beef-tea, and $1\frac{1}{2}$ c.c. of this was injected subcutaneously into the right thigh of these six hoggs. The same quantity was similarly injected into the right thigh of each of six other blackfaced hoggs which had been born and brought up on the farm. The twelve animals were placed in an enclosed field side by side and under exactly the same conditions. Within forty-eight hours, one of the native sheep was noticed to be ill: the inoculated leg hung down, and the animal was in a listless, dazed condition. It died with typical braxy a few hours afterwards. Another of the same lot was noticed to be somewhat dull, but ultimately recovered. None of the Aberdeenshire hoggs showed the slightest symptom of illness. They have remained on the same pasture up till now, and are perfectly well, having passed scathless through a second braxy season. Of the local sheep, I am informed that two have since died, but from what is not quite certain.

The virus in this case must, I think, have been of a mild form, and probably this accounts for so many having escaped; but evidently the Aberdeenshire sheep were less susceptible to

it than those reared on the West coast—for not only were they placed under the most disadvantageous circumstances, being moved from one district to another, but they were actually inoculated with the virus from a dead animal.

What this resistance depends upon I do not know, but quite likely Aberdeenshire sheep take a mild attack of the disease in the autumn or early winter which renders them immune. The following observation seems to support that view. Two black-faced Aberdeenshire lambs were inoculated with the same virus used in the experiment just quoted, but at the end of August instead of the beginning of January. One of them died within forty-eight hours with all the signs and symptoms of braxy, and its body was found to be swarming with the bacillus. This lamb was evidently not immune, and possibly the reason of this was to be found in its not having suffered as yet from the disease.

It seems very likely also that the bacillus gains in virulence by being passed through the system of the sheep. Thus the organism in the peritoneal liquid from the last-mentioned sheep was grown for two days in glucose beef-tea in a pure state. The culture was inoculated during the month of February into the right thigh of six Aberdeenshire hoggs. Within forty-eight hours, one of the six had died from braxy and two others succumbed in a few days afterwards. This is an experience I have never had before with Aberdeenshire sheep, and I think that it may be explained by the excessive virulence of the organism, due to its having passed through the system of three animals. Certainly I never saw the organism so actively engaged in sporing as in this particular virus.

It would even seem that it gains in virulence by being passed through the system of the guinea-pig. With a particular virus, on one occasion, I endeavoured repeatedly, but in vain, to inoculate an Aberdeenshire hogg. The same virus was passed in succession through the abdomen of three guinea-pigs, and was thereafter again inoculated into the thigh of the same hogg. It died within the usual time, with eroded hæmorrhagic patches in the fourth stomach and its tissues and blood pervaded with the typical bacillus.

It is well known that the subcutaneous injection of acetic acid simultaneously with the bacillus of quarter-evil in a state of attenuation, has the property of restoring that organism to its original virulence. My experiments with attenuated braxy bacillus seem to demonstrate the same fact. The most severe case of experimental braxy which I have witnessed was one in which acetic acid was injected into the right thigh, an attenuated peritoneal liquid into the left.

Introduction of the Poison into the System of the Sheep.

How it is that the virus gets into the body of the sheep remains a mystery. Jensen upholds the view that it is ingested with the food, but against this theory is the fact before referred to that no one has ever induced braxy by administration *per os.* It seems unlikely that the tick plays an active part as intermediary host. Braxy does not occur at a time when ticks are prevalent, and frosty weather has been proved to cause the tick to pass into a torpid condition. In my own mind I am convinced that the one means of generating and spreading braxy is fouling of the ground from the carcasses and various excreta of animals dying of the disease. We have seen how very insusceptible the spores of braxy prove to be to various extraneous agencies, and it only stands to reason, if myriads of these spores are left in the soil from a carcass, or are blown about in the form of dust, that, sooner or later, they will find their way into the bodies of sheep feeding on the infected pastures.

Preventive Treatment.

I shall say nothing on the present occasion of preventive treatment of the disease, as my observations on this subject are only in progress at present. The Board of Agriculture Committee will go into the whole matter fully in course of time, and will issue a report upon the same as soon as their researches are completed.

THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1901, AND METEOROLOGY OF THE YEAR RELATIVE THERETO.

THE CROPS.

THE following comparison of the cereal and other crops of 1901 with those of the previous year has been prepared by the Secretary of the Society from answers to queries sent to leading agriculturists in different parts of the country.

The meteorology of the year has been furnished by Dr Alex. Buchan, Secretary of the Meteorological Society of Scotland.

The queries issued by the Secretary were in the following terms:—

1. What was the quantity, per imperial acre, and quality of grain and straw, as compared with last year, of the

following crops? The quantity of each crop to be stated in bushels. What quantity of seed is generally sown per acre?—(1) Wheat, (2) Barley, (3) Oats.

2. Did the harvest begin at the usual time, or did it begin before or after the usual time? and if so, how long?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards ryegrass and clover respectively? The quantity to be stated in tons and cwts.
4. Was the meadow-hay crop more or less productive than last year?
5. What was the yield of the potato crop, per imperial acre, as compared with last year? The quantity to be stated in tons and cwts. Was there any disease? and if so, to what extent, and when did it commence? Were any new varieties planted, and with what result?
6. What was the weight of the turnip crop, per imperial acre, and the quality, as compared with last year? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird? Was more than one sowing required? and why?
7. Were the crops injured by insects? State the kinds of insects. Was the damage greater or less than usual?
8. Were the crops injured by weeds? State the kinds of weeds. Was the damage greater or less than usual?
9. Were the pastures during the season of average growth and quality with last year?
10. How did stock thrive on them?
11. Have cattle and sheep been free from disease?
12. What was the quality of the clip of wool, and was it over or under the average?

From the answers received, the following notes and statistics have been compiled:—

EDINBURGHSHIRE. *Wheat.*—44 to 50 bushels; crop better than last year; quality fine; straw about the same; 3 bushels seed sown.

Barley.—48 to 56 bushels; quality superior to last year; straw fully more; 3 bushels seed sown.

Oats.—50 to 56 bushels; quality very fine; straw about the same as last year; 4 bushels sown.

Harvest began rather earlier than last year. Weather very good both for cutting and taking in the crop.

Hay.—A better crop than last year. First crop about 3 tons. Second well got; about 30 cwt. *Meadow-hay*—A light crop, but very well got.

Potatoes.—Better than last year; from 8 to 10 tons; almost no disease.

Turnips.—Not such a crop as last year; about 20 to 25 tons. Brairded well, and almost no second sowing. Not injured by fly. *Mangold*—A very heavy crop; 25 to 30 tons.

No damage by insects or weeds.

Live Stock.—Pastures deficient from last year, owing to the dry weather. Stock healthy and quite free from disease. Both cattle and sheep throve well. *Clip of wool*—About the same ; prices lower.

LINLITHGOWSHIRE. *Wheat.*—Better in quantity and quality than last year ; from 36 to 40 bushels ; seed from 2½ to 3 bushels.

Barley.—Better in quantity and quality than last year ; from 36 to 44 bushels ; seed from 2½ to 3 bushels.

Oats.—Better in quantity and quality than last year ; from 36 to 44 bushels ; seed from 4 to 5 bushels.

Harvest began and ended a month earlier than last year.

Hay.—About the same in quantity, and much better in quality, than last year ; from 1½ to 2½ tons. *Meadow-hay*—Very little grown.

Potatoes.—Much better than last year ; from 6 to 12 tons. Almost no disease.

Turnips.—Not so good as last year ; from 10 to 20 tons. Not much second sowing. Good deal of finger-and-toe and mildew.

No injury by insects or weeds.

Live Stock.—Not so good as last year ; suffered much from drought in July and August. Stock did not thrive well, but free from disease. *Clip of wool*—Average.

HADDINGTONSHIRE (Upper District). *Wheat.*—None grown.

Barley.—28 to 36 bushels ; quality of grain better than last year ; quality of straw about the same as last year, but less in quantity ; 3 bushels sown.

Oats.—32 to 40 bushels ; quality of grain and straw better than last year ; straw a short crop ; 4 bushels sown.

Harvest began the same time as last year.

Hay.—2 tons ; quantity less, but of better quality than last year. *Meadow-hay*—Less productive.

Potatoes.—5 to 6 tons. Very little disease. No new varieties planted.

Turnips.—18 to 20 tons ; better quality. Crop brairded well. Only one sowing required.

No injury by insects or weeds.

Live Stock.—Pastures of average growth and quality. Stock throve very well and were free from disease. *Clip of wool*—Average.

HADDINGTONSHIRE (Lower District). *Wheat.*—About 48 bushels ; quite as much straw as last year ; 3½ bushels sown.

Barley.—48 bushels ; better in quantity and quality than last year ; 2¾ bushels sown. Straw just about the same in quantity ; better quality ; not wasted by the weather.

Oats.—40 to 48 bushels, or about the same as last year ; straw very short in most cases, but good quality ; 4 bushels sown, and even more in the case of some of the new varieties.

Harvest began 6th August, or fully a week earlier than last year. Exceptionally good weather, and crops all secured in good condition.

Hay.—2 to 2½ tons ; very fine quality. Did not get a drop of rain from the time it was cut till it was into the stack in most cases. *Meadow-hay*—None grown.

Potatoes.—Up-to-Dates a very big crop, 8 to 12 tons ; good quality. Maincrops a very small crop, 4 to 6 tons. Earlier sorts a fair crop. Almost no disease, but a good deal of second growth.

Turnips.—About 10 to 15 tons. Brairded well, but mildewed very early. Lightest crop in this district for many years.

The diamond-backed moth was seen in some places, and did some damage, but not so much as last year. No injury by weeds.

Live Stock.—Pastures under an average. Stock did not do so well as usual, partly on account of the extreme heat. Cattle and sheep free from disease. *Clip of wool*—About an average.

BERWICKSHIRE (Merse). *Wheat.*—36 bushels; both quantity and quality much superior to last year; harvesting early and in ideal weather; straw a little under an average; seeding about 3½ bushels. Wheat, it may be noted, is only grown under favourable conditions as to soil and climate.

Barley.—30 bushels, being little if any over last year's yield; straw also about last year's bulk, but about one-third under average; quality all over above an average, and much better than last year. The early and continued drought, coming as it did after the wet weather of March and first half of April, seriously affected the crop on the strong lands of the Merse. Seeding, 3 bushels.

Oats.—36 bushels; straw considerably under last year's average, but quality much better; seeding, 4 bushels.

Harvest began about a week before the average date, and was general about the 12th August. It was most expeditiously conducted.

Hay.—Much under an average crop, 32 cwt., but secured in splendid condition. Aftermath almost entirely wanting. Clover much thinner than last year, and ryegrass very short. *Meadow-hay*—Was a most unproductive crop, and, except in most favourable conditions, was much under an average.

Potatoes.—The potato is the crop of the season for quantity, quality, and size; 8 tons, or in many cases much more—say 20 per cent above an average; one-third more than last year. Many maximum crops are reported. No disease; second growth only slightly apparent. New varieties not much patronised.

Turnips.—Crop brairded fairly well, though there was some resowing. The drought severely affected the crop, which is much under last year's. Mildew was very severe, and the caterpillar of the diamond-back moth did very serious damage to many fields. Crop average 16 tons, or 10 per cent under last year.

Caterpillar of diamond-back moth was most destructive in many parts to turnip shaws. Weeds of all kinds were easily kept down owing to the prevailing dry weather.

Live Stock.—During May pastures were good and of average growth. June, July, August, and the half of September were exceptionally dry, and pastures were very bare and much under average growth. Rains in the middle of September brought away a rapid growth, and during autumn and early winter pastures were everywhere fresh and good. As a whole pasture was very deficient as compared with last year. The drought seriously affected grazing stock in July and August, but except in cases where there was too much growth for young stock in September, both sheep and cattle have done well, though financially prices have not remunerated the grazier. Little or no disease. *Clip of wool*—Good quality, and, owing to the fair turnip crop and mild winter, over an average.

BERWICKSHIRE (Lammermoor). *Wheat.*—Almost none grown.

Barley.—Crop generally light, but yielding well; 32 bushels; quality above average, and superior to last year; straw very deficient; seeding, 3 bushels.

Oats.—34 bushels; fine quality; straw at least one-third deficient as compared with last year. Generally harvested in fine weather, except in the later districts. Seeding, 4½ bushels.

Harvest.—Ten days before the average date, being general about the 20th of August, or about a week behind the date of general harvest in the Merse, instead of the usual fortnight. Some rain in the middle of September somewhat delayed operations in the later districts.

Hay.—Very light crop, 25 cwt.; quality as good as could be, considering the short growth. Clover under average, and aftermath very deficient. *Meadow-hay*—This was the most disappointing crop for years,—only about half of last year's yield,—but well secured.

Potatoes.—Crop excellent in quality and quantity; at least one-half more than last year; 7 to 9 tons. No disease. Up-to-Date most prominent variety.

Turnips.—Brairded well, and the early growth was exceptionally luxuriant. Almost no resowing. The growth was only stopped by the excessive drought, which caused mildew in many parts. Crop 19 tons, or 5 per cent under last year. It is, however, a variable one, some dry patches producing poor results, while others show crops much above an average.

No abnormal injury to crops from insect pests was noticed. Weeds of all kinds were easily kept down owing to the prevailing dry weather.

Live Stock.—The remarks given for the Merse largely apply to Lammermoor. On damper lands and on the hills pastures have been excellent all season. Stock generally grazed well—on hill pastures very well. Little or no disease. *Clip of wool*—Good quality and about an average bulk, being 4 per cent over the clip of the previous year.

ROXBURGHSHIRE. *Wheat.*—About 25 bushels; quality average; straw deficient.

Barley.—About 30 bushels; quality good; straw average.

Oats.—About 33 bushels; quality good; straw rather under average.

Harvest began rather earlier; short harvest.

Hay.—Under average, and almost no clover; about 28 cwt. *Meadow-hay*—Crop rather less, but well got.

Potatoes.—Nearly double of last year; about 8 tons, and almost no disease.

Turnips.—In the earlier districts quite below an average, but fully an average in late districts; the former about 16 tons, the latter fully 20 tons. No second sowing.

Almost no damage by insects. A good deal of wild mustard or runches.

Live Stock.—Pastures about the same, but a want of clover, which was a great loss for the feeding of stock. Stock did not thrive well. Cattle and sheep free from disease. *Clip of wool*—Quality generally good and about average quantity.

SELKIRKSHIRE. *Wheat.*—None grown.

Barley.—30 bushels; grain and straw better.

Oats.—32 bushels; grain and straw much better.

Harvest about ten days earlier.

Hay.—1 ton 12 cwt.; excellent. *Lea-hay*—Excellent.

Potatoes.—Great yield; 10 tons; about double. No disease. Usual kinds.

Turnips.—18 tons; much the same as last year. Brairded well; no resowing.

No injury by insects or weeds.

Live Stock.—Pastures better. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—Good; over average.

PEEBLESSHIRE. *Wheat.*—None grown.

Barley.—None grown.

Oats.—32 bushels ; 5 bushels sown ; 1 ton 5 cwt. straw.
Harvest began fifteen days earlier.
Hay.—2 tons ; quality good. Clover scarce. *Meadow-hay.*—Crop less.
Potatoes.—9 tons. No disease, also no new varieties.
Turnips.—24 tons. No resowing ; brairded well.
No injury by insects or weeds.
Live Stock.—Pastures during the season of average growth and quality with last year. Stock throve well and were free from disease.
Clip of wool.—Under average.

Dumfriesshire (Annandale). *Wheat.*—None grown.
Barley.—Not a large quantity of barley grown. Straw under last year's return ; about 22 cwt. Quality better than last season. Yield of grain, 40 bushels—35 last year. Colour excellent, owing to crop being secured with little or no rain. 3 to 4 bushels sown.
Oats.—Weight of straw under last year, but quality much superior. Weight about 28 cwt. Thrashes from 40 to 75 bushels, according to variety grown, or about 10 bushels more than last year. Potato and Sandy oats give an average of about 40, Tartar King and New Market from 60 to 80, according to quantity of seed sown. Quality of grain is better than last year. Quantity of seed sown from 3½ to 4 bushels when drilled ; broadcast, 4 to 5, and on some farms as high as 6 bushels. A good many farmers complain that the fodder from the new varieties is rough. This is because too little seed is sown. They do not take the size of seed into account. If Potato is sown at 4 bushels, Tartar King and Abundance would require 7 to have the same fineness of seed.
Harvest began 5th August, as against 27th in 1900—about a fortnight before the usual time.
Hay.—Owing to there being more clover there was a heavier yield than in 1900. Quality better than in 1900, owing to exceptionally dry weather. 33 cwt. as against 28 in 1900. *Meadow-hay*—Crop generally acknowledged to be about the same weight and quality as in 1900.
Potatoes.—Farmers put this at from three to four times the bulk of last year. The writer saw crops lifted that would yield 15 tons, and some farmers say they lifted 18 to 20. The potato crop may be said (in this district) to be phenomenal.
Turnips.—About 18 tons. For bulk, would compare with 1900. Quality inferior. First sowing brairded badly, and had to be resown. Causes—cold, dry weather in May, with frost at night and damage by fly.
With the exception of the turnip fly, crops were remarkably free from insect pests. Turnip fields (all over) were covered by the weed known locally as "redshank." Farmers say they were ashamed, but owing to scarcity of labour and a much greater breadth of hay they were unable to get them cleaned.
Live Stock.—Pastures on average soils were of more than average quality, but light or gravelly soil suffered from drought. Stock throve well. Cattle generally have been free from disease, but dairy cows seem to have been unusually troubled with udder troubles. "Gasger" was very prevalent (unusually so). On the other hand, sheep on turnips have been unusually free from the scourge "pea braxy" generally so prevalent in this district. *Clip of wool*—Generally acknowledged to be under average.

Dumfriesshire (Nithsdale). *Wheat.*—None grown.
Barley.—None grown.
Oats.—Quality above an average, and quantity about 35 bushels. If on light land, straw was not bulky, but all secured in fine condition. Quantity sown about 5 bushels.

Harvest began about a week before usual time.

Hay.—About $1\frac{1}{2}$ tons of fine quality. Much less than last year, of clover particularly. A very fine hay harvest, and weighed out well. *Meadow-hay*—About one-third less than last year. All got in splendid condition.

Potatoes.—About 10 tons, more than double last year's yield. The quality first class, and altogether the crop of the season. No disease.

Turnips.—About 20 tons of good quality. Swedes started badly, but came on wonderfully later. Sowing twice quite common owing to drought and fly.

Destruction by turnip fly worse than usual. Weeds not worse than usual, but thistles more abundant than grass at midsummer on some farms.

Live Stock.—Pastures were bare during summer, but improved and were good in late autumn. Stock did well, and milk cows continued a fairly good yield in the back end of season. Cattle free from disease. More sheep were lost on the hills than usual owing, it is believed, to the wet weather of the previous back end. *Clip of wool*—Quality good, and clip rather more than previous year, and considered average.

DUMFRIESSHIRE (Eskdale). *Wheat.*—None grown in this district.

Barley.—Practically none grown.

Oats.—38 imperial bushels. Quality of grain extra good, and well got; ripening uniformly, the dry summer contributing to this. Not only well filled, but so well matured that it felt as hard and dry as old corn, and as a result was more than equal to old corn on an average of years when cut. 5 imperial bushels sown. Straw extra quality; quantity about 1 ton 4 cwt.

Harvest began a week earlier than the average of years.

Hay.—Ryegrass and clover hay cut better than it looked, and especially well got, and weighed heavier from the pike than it did the previous year, although not quite so bulky a crop, and thus equalising the weight of hay to the previous year—30 cwt. Price realised, taken from the field and delivered by the grower, 4d. per imperial stone, or $\frac{1}{2}$d. per stone above last year; but the price has hardened since by fully 1d. per stone. *Meadow-hay*—Meadows were light, but the later cut ones improved immensely by the rains in the latter end of July, bent-grass on the hills growing amazingly after this period; and in consequence of a fine dry summer, a vast amount of hay was secured in the very best condition, especially upon the hills, where hay-making was carried on until very late in the season, which has tided over many farmers through a protracted snowstorm.

Potatoes.—A grand crop everywhere, yielding more than double that of last year; quality most satisfactory, and little disease; average yield fully 7 tons. Complaints, however, are rife that they are not keeping well in the pits, especially Up-to-Dates. No new varieties planted.

Turnips.—A capital crop, notwithstanding a more than usual acreage had to be sown over again, principally owing to the excessive dry weather when sown, seed often not brairding at all, but more frequently eaten by the fly when they did come; but, thanks to genial rains on the early days of June, they came away vigorously at last. Later on, supplemented by a plentiful supply of rain, the bulbs grew apace, resulting in a splendid crop, averaging fully 25 tons. Some crops there are quite 40 tons, but these, of course, are exceptional. Unfortunately a general complaint of disease amongst the heavier crops are prevalent, but not to any serious extent, just odd turnips here and there, the disease beginning at the root of the shaw and speedily becoming a rotten mass.

Injury by insects more than usual and the damage greater, the common

black turnip fly being the depredator. Not much injury by weeds, the dry summer enabling the farmers to thoroughly extirpate them, charlock being the principal and most troublesome; but by using the sprayer, they have within their reach an effectual remedy. Unfortunately seed oats are frequently sold with great quantities of charlock seed in them, and this is a fruitful source of propagating the pest.

Live Stock.—In many districts grass was burnt up, and particularly in this locality; but opportune rains saved the situation in a great measure, and in consequence not much injury accrued; in fact in the autumn months a great rush of grass came, making the fields assume a most unusual verdant green, which lasted until the frost came. Stock throve very well indeed, having an abundance of luscious grass to feed upon all through the autumn months. Cattle and sheep fairly free from disease; but, as usual in this district, the prevalent disease of braxy claims a heavy percentage amongst the hoggs on hill grounds, and some heavy losses have occurred when hoggs were first turned on to turnips, probably owing to the crop not having arrived at maturity, as this loss invariably occurs when very early stocked, but which might be greatly lessened by feeding liberally with hay. *Clip of wool*—A little over average in quantity, but not in quality, and price ridiculously low, on one farm within the knowledge of many the clip of wool not quite realising the shepherd's wage.

KIRKCUDBRIGHTSHIRE. *Wheat.*—Grain about 36 bushels; straw an average crop; seed, 3 bushels.

Barley.—Grain, 34 bushels; straw under average; seed, 3½ to 4 bushels.

Oats.—Grain, 37 bushels; straw barely average; seed, 4½ to 5 bushels.

Harvest began about a week earlier than usual.

Hay.—1¼ to 1½ tons; under average; quality very fine. *Meadow-hay*—Less than average, 20 to 25 cwt.; quality fine.

Potatoes.—About 6 tons; little or no disease.

Turnips.—18 tons. Brairded fairly, but a good deal resown owing to drought.

Some loss by wireworm, but not more than usual. Early-sown swedes came slowly, and were in some cases much overgrown with annual weeds.

Live Stock.—Pastures above average quality, but less in growth. Stock throve well and were free from disease. *Clip of wool*—Good; weight about average.

WIGTOWNSHIRE. *Wheat.*—30 bushels; grain and straw of average quality; seed sown, 3 bushels; but very little of this crop now grown.

Barley.—32 bushels; quality good; straw average in quantity and quality. In a few cases in which crop was late in being sown, bad weather was experienced in harvesting.

Oats.—36 bushels; both oats and straw very good, but the latter one-sixth less in quantity than last year. Crop was secured in fine condition.

Harvest began about a week earlier than last year.

Hay.—32 cwt., being less than last year. *Meadow-hay*—Less productive, arising from the specially dry summer.

Potatoes.—5 tons this year—great increase over last year. Disease was much under average. No new varieties planted.

Turnips.—18 tons, being deficient from last year. Good braird, and very little second sowing required.

No damage by insects. No weeds.

Live Stock.—Pastures of average growth, except that owing to the dry weather in summer they were somewhat bare at that time. Stock throve well. Cattle and sheep free from disease generally. *Clip of wool*—Quality good; quantity average; but price miserable.

AYRSHIRE. *Wheat.*—None grown.

Barley.—44 bushels; straw good quality and abundant.

Oats.—48 bushels; straw fine quality; standing crop.

Harvest usual time; early if anything, 12th August.

Hay.—1 ton 12 cwt.; light crop. *Meadow-hay*—Average; fine quality.

Potatoes.—Early crops light weight; 4 tons. Second early and later lots, 9 tons. No disease on account of fine dry weather when maturing. No new varieties.

Turnips.—21 tons. Brairded well, but suffered from drought later.

Maggot on turnip and cabbages during August did great damage to these crops. Usual weeds.

Live Stock.—Pastures bare during summer, but stock throve well on them. Cattle and sheep free from disease. *Clip of wool*—Average; 6 lb. on arable lands from cross hoggs.

BUTE. *Wheat.*—One lot in Bute, yield 40 bushels; seed sown, 3½ bushels.

Barley.—Under average; 34 bushels; straw under average; seed sown, 4 bushels.

Oats.—An average; well got; 36 bushels; seed sown, 5 bushels.

Harvest two weeks sooner than usual; began middle of August; the shortest harvest on record; finished 6th September.

Hay.—An average crop; 2 tons; very well got. *Meadow-hay*—Not much grown here.

Potatoes.—Early crop: began to dig them 14th of June; 5 tons; under average. Late potatoes: good crop; 8 tons.

Turnips.—The crop was an average one; 20 tons. They brairded well; very little resowing. Finger-and-toe in some cases. On several farms where certain seeds were sown there was not a sound turnip in the lot.

No injury by insects or weeds.

Live Stock.—The pastures were a good average here. Stock did well. Cattle and sheep have been free from disease. *Clip of wool*—An average. The prices have been extremely low.

ARRAN. *Wheat.*—None grown.

Barley.—None grown.

Oats.—Good crop; straw fine quality; yield rather better than last year, say 32 to 34 bushels; weight, 40 lb.; seed sown, 6 bushels.

Harvest began a week earlier than last year.

Hay.—Light, but well got; yield about 20 cwt.; seed, good quality. *Meadow-hay*—Less productive; very little grown; well secured.

Potatoes.—Very large crop; fine quality; yield, say 6 tons early varieties; late, up to 9 tons. Very little disease.

Turnips.—Early-sown swedes good crop; brairded well. Late and yellows not so regular. A good deal of mildew and finger-and-toe.

No injury by insects. Weeds less than usual.

Live Stock.—Pastures good quality, but not so much clover as we have seen. Stock did fairly well—not better than last year. Cattle and sheep very free from disease. *Clip of wool*—Over last year, and of better quality.

LANARKSHIRE (Upper Ward). *Wheat.*—None grown.

Barley.—None grown.

Oats.—About 36 bushels. A good crop on heavy land, but deficient on light soils owing to want of rain. Both grain and straw of best quality, but quantity, particularly of straw, less than last year. Seed sown, 5 to 6 bushels.

Harvest began in the last fortnight of August—about a week earlier than usual—and was finished quicker owing to favourable weather; the best for a number of years.

Hay.—$1\frac{1}{2}$ to 2 tons, being considerably less than last year owing to want of rain; quality better. *Meadow-hay*—Bulk about a third less than last year.

Potatoes.—Average about 8 tons, being considerably better than last year; quality excellent; little or no disease. Sutton's, Up-to-Date, and British Queen's are the principal varieties.

Turnips.—26 to 30 tons; about the same as last year, but quality much better. Brairded well, and no resowing.

Injury by insects not more than usual. Weeds not more than usual.

Live Stock.—Pastures less than average growth owing to want of rain; quality good. Stock throve well. Cattle and sheep free from disease, though possibly more deaths among ewes. *Clip of wool*—Quantity and quality up to average, but prices exceedingly low.

Lanarkshire (Middle Ward). *Wheat.*—40 bushels; quality of grain and straw very good; lighter than previous year. Very small acreage sown owing to the wet back end of 1900. $3\frac{1}{2}$ bushels sown.

Barley.—Little grown.

Oats.—40 bushels; good even crop; both grain and straw good quality.

Harvest began about the same time; week earlier in the later districts. Weather good.

Hay.—Lighter than previous year. Ryegrass 30 cwt.; timothy fully 40 cwt. Weather good for securing. *Meadow-hay*—Average, and better secured than former year.

Potatoes.—Splendid crop; Up-to-Date, Scottish Triumph, and British Queen's dressing to 12 tons. No disease to speak of.

Turnips.—Failure in some districts; finger-and-toe general. Where the crops were sound, yellows would yield to 25 tons, swedes from 30 to 35 tons.

No injury from insects. No damage from weeds; easily killed during the fine weather.

Live Stock.—Hardly as much pasture, owing to dry season, but quality good, and stock throve well. Cattle and sheep free from disease. *Clip of wool*—Average.

Lanarkshire (Lower Ward). *Wheat.*—About 40 bushels as an average crop, taking all the district into account; but the straw was shorter than last year owing to the dry season. 4 bushels sown.

Barley.—Little grown.

Oats.—Were very short of straw in a lot of cases, but the yield of grain very good—35 bushels would be the average.

Harvest was quite ten days earlier than last year—started about the 15th August—and a very good one.

Hay.—Ryegrass was a light crop, $1\frac{1}{2}$ ton; about an average. *Meadow-hay*—A fair good crop; rather dry for it also.

Potatoes.—The crop of the season; 10 tons; an average crop, and very little disease. Few new kinds planted.

Turnips.—A good crop also; 20 to 25 tons as an average, and they brairded well. No second sowing.

No injury by insects. Very little injury from weeds, with the exception of skellock.

Live Stock.—Pastures fairly good; Stock throve very well. Cattle and sheep free from disease.

RENFREWSHIRE. *Wheat.*—Quantity much the same; quality of both grain and straw better than last year; 4 bushels sown.

Barley.—Same as wheat.

Oats.—Quantity not so much as last year, but better quality of both grain and straw. 5 bushels sown.

Harvest began about two weeks before the usual time, and was the best we have had for years.

Hay.—The crop was lighter than last year. Ryegrass and clover of the best quality. *Meadow-hay*—Less productive.

Potatoes.—Crop very good; much the same quantity as last year, but better quality. A few new varieties planted, but not so many as in some former years.

Turnips.—As a rule, not so heavy a crop. Did not braird so well; did not need resowing, however. About 5 tons below average.

Damage done by fly was slight. The dry weather caused lightness of crop.

Live Stock.—Pastures very good, and a second growth gave stock a good fresh bite till late in season. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—Not above the average.

ARGYLLSHIRE (District of Lochgilphead). *Wheat.*—None grown.

Barley.—None grown.

Oats.—Grain of superior quality and greater quantity than last year; yield about 40 bushels; a slight deficiency in quantity of straw, but quality good; 6 bushels sown.

Harvest started on 19th August, a week earlier than usual.

Hay.—Crops rather heavier and of better quality than last year; about 1 ton 18 cwt. *Meadow-hay*- Less productive.

Potatoes.—Rather better than last year; about 7 tons. Early varieties slightly diseased, which started in August.

Turnips.—Swedes of rather better quality and heavier crop than last year; about 27 tons. Yellows about same weight as last year, but not such quality. Brairded well; only one sowing.

No injury done by insects. Crops did not suffer by weeds.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve very well and were free from disease. *Clip of wool*—Average clip, of fair quality.

ARGYLLSHIRE (Kintyre). *Wheat.*—None sown in the district.

Barley.—Equal in quantity, but better in quality. Barley is generally sown on the best of the land in the district, which accounts for a fair yield; dry season and good harvest weather accountable for the quality. Quite 33 bushels; in some cases more, in others less. About 4 bushels sown.

Oats.—Much the same in quantity, but considerably better in quality. Oats are grown on the poorer lands, especially after green crops. The lea land crop of oats were very good; no worming; about 34 bushels. Straw excellent. On the lowlands more than quoted, but on the high and poor lands of the district considerably less. About 5 bushels sown.

Harvest began about eight days earlier.

Hay.—Not as large a crop as last year, owing to the drier season, but quality all that can be wished. Clover did fully better among the ryegrass this year than last, although the foggage after hay was barely as good owing to the dry season. Average about 1 ton 12 cwt. *Meadow-hay*—Less in quantity, but better got.

Potatoes.—Better than last year; about 5 tons; quality good; very little disease; commenced about 1st September. A few new varieties planted, and did very well; almost free from disease.

Turnips.—Quantity and quality much the same as last year. The earlier sown ones did best, having brairded before the land got too dry; after the 15th of May did not braird well—land got too dry. Very little resowing owing to fly. On the better land up to 25 tons, on the poorer land 10 tons; average about 15 tons.

Very little damage by insects on any crops in this district. Less weeds this year, especially in green crops, as the dry season was favourable for killing them. Wild kail, yare, runches, and chicken-weed are the most troublesome weeds.

Live Stock.—Pastures were about equal to last year in quantity and quality. Stock throve much the same as last year. The dry season did not appear to favour the thriving of the stock more than a wetter one. No particular disease among cattle, except a few cases of tuberculosis. Sheep have done fairly well. Less braxy among hoggs this year than usual. *Clip of wool*—Much the same as last year both in quantity and quality, I would say about an average.

ARGYLLSHIRE (Islands of Islay, Jura, and Colonsay). *Wheat.*—None grown.

Barley.—Very little grown

Oats.—Much the same as last year. A very good crop both of straw and grain; 5 to 6 bushels seed sown. Grain weighs better than last year.

Harvest began and was finished at least three weeks before the usual time.

Hay.—Good average crop both of ryegrass and clover. Not quite so heavy as last year. *Meadow-hay*—Much the same as last year.

Potatoes.—At least one-third heavier than last year. There was little disease, but in some cases considerable damage was done by grubs or worms eating into the centre of the tubers.

Turnips.—20 to 35 tons; good crop; much the same as last year. Brairded well, except where ground was too dry, in which case a second sowing was required. Gulls and crows did some damage by pulling up turnips after they were thinned.

Damage by insects much the same as usual. Owing to dry weather weeds were more easily destroyed than usual.

Live Stock.—Pastures during the season of average growth and quality with last year, except early in the season, when they suffered from drought. Stock throve better than usual. Cattle and sheep free from disease; death-rate about an average or rather under. *Clip of wool*—Good average clip.

ARGYLLSHIRE (Inveraray District). *Wheat.*—None grown.

Barley.—Scarcely any. This was a good year for barley.

Oats.—A good crop with good head, but straw rather short; crop unusually well saved; probably 30 to 32 bushels.

Harvest began about ten days earlier, owing to sunny dry weather.

Hay.—Ryegrass about the usual weight, and meadow-hay on damp ground heavy, on dry land light. Ryegrass probably 25 to 28 cwt. Meadow-hay on damp ground 40 cwt.; on dry land, second and other crops, from a ton to 30 cwt. All well secured.

Potatoes.—A capital yield of best quality.

Turnips.—An irregular crop. Early sown came away at once and was heavy, but later sown long of coming, and, partly owing to rabbits and wood-pigeons, comparatively useless.

No damage from insects. Very little damage by weeds.

Live Stock.—Grazing good, and stock throve well, unless on thin soil, and were free from disease. *Clip of wool*—Generally light, owing to deaths in spring.

DUMBARTONSHIRE. *Wheat.*—About 34 bushels; grain good; not so much straw as last year; seed, about 3 bushels.

Barley.—No returns; very little grown.

Oats.—About 38 bushels on the best land to 25 bushels on the higher districts; quality very good; straw less than last year; seed, 4 to 5 bushels.

Harvest about a week earlier.

Hay.—Crop very good; quality much better than last year, but not so much of it. From 1 ton 15 cwt. on the best lands to 1 ton 5 cwt. on the higher lands. *Meadow-hay*—A good crop and well got—better than last year.

Potatoes.—7 to 8 tons in early crop, and 8 to 10 in winter crop. Very little disease. One new early variety, Epicures; very early good cropper, and fair quality.

Turnips.—Swedes, 30 tons; yellows, 28 tons on best land, down to 18 tons on higher lands. Brairded well; no resowing.

No damage by insects reported, except some small plots of wheat injured by wireworm. Very few weeds, owing to dry weather.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve very well. Cattle and sheep free from disease; but sheep were troubled very much with maggots, more so than usual. *Clip of wool*—An average clip; better than last year.

STIRLINGSHIRE (Western District). *Wheat.*—None sown in district.

Barley.—Little grown; good crop; 36 bushels; grain and straw fine quality and well secured.

Oats.—Good crop; 37 bushels; both grain and straw good. Late-sown parts light, owing to clear forcing weather during early harvest. All finely secured.

Harvest commenced about same time as last year.

Hay.—Fine crop; 33 cwt. Well mixed with clover, and secured in fine condition. *Meadow-hay*—Average crop; well secured with little labour.

Potatoes.—A heavy crop of 7 to 11 tons of good quality, solid and sound. No disease. No new varieties grown.

Turnips.—About 30 tons of fine sound bulbs free of disease. Some of the free-growing kinds do not keep well during winter, but are quite good for early use. No variety keeps better than the hardy old green-top swede. No second sowing.

No injury by insects.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—Good quality and average quantity.

STIRLINGSHIRE (Eastern District). *Wheat.*—3½ bushels seed produce 38 bushels; straw and grain middling; small acreage.

Barley.—3 bushels seed. Clay, 36 bushels; dry-field, 30 bushels. Grain good quality and straw good.

Oats.—5 bushels seed; 40 bushels; grain and straw of first quality.

Harvest.—Good medium early harvest.

Hay.—Clay, 40 cwt.; dry-field, 30 cwt. Very much better than last year. *Meadow-hay*—Small crop, but well got.

Potatoes.—Very big crop; 8 tons yield; no disease.

Turnips.—20 tons; some finger-and-toe; no second sowing.

No injury by insects.

Live Stock.—Very poor grass year. Stock did not thrive well. Cattle and sheep free from disease. *Clip of wool*—Under an average.

FIFESHIRE (Eastern District). *Wheat.*—44 bushels; quality and quantity better than last year; straw, 35 cwt.; 3½ to 4 bushels sown.

Barley.—44 bushels; straw, 25 cwt.; quality and quantity better than last year; 3½ to 4 bushels sown.

Oats.—48 bushels; straw, 25 cwt.; quality better than last year; seed sown, 4 bushels.

Harvest early, about one week before usual time.

Hay.—35 cwt.; quality good; an average crop. *Meadow-hay*—Very little grown in the district.

Potatoes.—7 or 8 tons; much better than last year; very little disease. No new varieties of any importance.

Turnips.—Swedes, 18 tons; yellows, 14 tons. Quality good. Brairded well, and very little resowing.

No damage by insects or by weeds.

Live Stock.—Pastures were of the average growth. Stock throve fairly well. Cattle and sheep free of disease. *Clip of wool*—Good; average quality and quantity.

FIFESHIRE (Middle District). *Wheat.*—The yield will be from 36 to 40 bushels. The quality both of grain and straw is excellent, many samples weighing 63½ lb. per bushel. Weight of straw about 35 cwt. There was not an average breadth of this grain sown, owing to the exceedingly wet weather in the autumn of season 1900. Quantity of seed—drilled, 3 to 3½ bushels; broadcast, 4 to 4½ bushels.

Barley.—This is the best crop of all the cereals, and the quality both of grain and straw is very much above the average. Samples of grain are weighing up to 58 lb. per bushel, and are of good colour. The yield is much better than that of last year; the average will be fully 44 bushels, and the weight of straw 32 cwt. Quantity of seed—drilled, 3 bushels; broadcast, 4 bushels.

Oats.—About an average crop as to weight of straw; but the yield of grain is fully more than an average one. It will thresh to 50 bushels, while the weight of straw will be about 30 cwt.; and the quality is excellent. It is very fine fodder. Quantity of seed—drilled, 4 to 4½ bushels; broadcast, 5 to 5½ bushels.

Harvest began about the middle of August, and may be said to have begun a fortnight before the usual time. It was as fine a harvest as any on record, many farmers having the whole crop secured in stackyard within four weeks after beginning to cut, and not a bad sheaf.

Hay.—Owing to severe drought in the month of June the hay crop was not a heavy one; it will scarcely average 30 cwt. It was secured in fine order, and is of good quality. There was very little aftermath, and generally not much clover among the hay, mostly ryegrass. *Meadow-hay* was less productive than last year, owing to the very dry and hot summer.

Potatoes.—The yield was very much better than last year, and the quality much superior also. The weight of an average crop, ware and small, will be about 7 tons. There was very little or no disease. There was no new variety introduced into field culture, but Up-to-Dates were more largely planted, and our district Committee in their experiment plots had a small plot of East Anglia, which promises well.

Turnips.—About a third less than last year. Taking swedes and yellows together, the crop will not be above 15 tons. Swedes are of fair quality, but yellows are inferior. There was not much resowing, but the crop was checked in early autumn with drought, causing mildew and premature ripening.

Oats to a small extent were damaged by grub and wireworm. Some trifling damage by wild mustard and charlock.

Live Stock.—Pastures were not nearly so luxuriant as last year, but

cattle and sheep throve much better, the leas being of better quality. Stock throve very well. Cattle and sheep free from disease, with the exception of some isolated cases of anthrax. *Clip of wool*—Average weight and quality.

FIFESHIRE (Western District). *Wheat.*—42 bushels; straw, 1¾ ton; quality of both excellent; seed sown, 4 bushels.

Barley.—40 bushels; straw, 1¼ ton; quality of both very fine; seed sown, 3½ bushels.

Oats.—40 bushels; straw, 1½ ton; quality of both very fine; seed sown, from 4 to 5 bushels.

Harvest much earlier than usual; began from the 12th to the 18th of August.

Hay.—1½ ton; quality excellent *Meadow-hay*—Considerably under last year in bulk on account of the dry summer, but the quality was far superior.

Potatoes.—Quantity is most difficult to state, as so many varieties are now grown; many being very heavy croppers, and others only moderate, I therefore give the approximate yield of two of the principal varieties grown—viz., Maincrop Kidneys and Up-to-Dates. The average yield of the former will be about 5½ tons, whilst the latter will yield 7 to 8 tons. Very little disease. Yes, many new varieties.

Turnips.—This crop is very light this season. Where well grown it will average about 20 to 25 tons, and on inferior plots say from 10 to 15 tons. It brairded fairly well, and there was little resowing, but the summer was much too dry for it.

Not much injury by insects. Turnips did suffer after being thinned by the diamond-backed moth, but generally recovered. Much greater damage by weeds and by yellow weed.

Live Stock.—Pastures good quality, but terribly burned up with the dry weather. Stock throve very well. Cattle and sheep perfectly free from disease. *Clip of wool*—About an average.

PERTHSHIRE (South-Western District). *Wheat.*—Very much less area grown in 1901 than for some years. Average yield, 34 bushels; straw deficient in quantity; 3½ bushels seed sown.

Barley.—On carse land, about 32 bushels; on dry-field land, about 28 bushels. Seed, 3 bushels; straw much under an average in quantity; grain good quality and well coloured.

Oats.—34 bushels; straw deficient in quantity, but of good quality; seed sown, 4 to 5 bushels.

Harvest began a few days earlier. Good weather most of the time.

Hay.—Yield on carse land, 1½ ton; well got and of good quality. On dry-field land the crop was very light, in most cases not much over 1 ton. *Meadow-hay*—Light crop, but well got. Not much meadow-hay grown in this district. The hay season was one of the best as regards weather.

Potatoes.—Crops much above an average; 6 tons; very little disease.

Turnips.—20 to 22 tons; good crop, but badly "cankered" on some farms. Brairded well, and no second sowing, nor damage from turnip-fly. In contrast to the potatoes, it is the newer varieties of turnips that seem to suffer most from disease.

No injury by insects. On account of the dry summer weeds were not so abundant as usual.

Live Stock.—Pastures under tillage were not up to the average, as the land was too dry; but old grass was good pasture, and suffered little from drought. Cattle did fairly well, but in most cases left little or nothing for summer grazing. They were generally bought in spring about 42s.

per cwt., and sold in the autumn for 32s. per cwt. No disease in this district. *Clip of wool*—Not above an average.

PERTHSHIRE (Coupar-Angus District). *Wheat.*—The average yield in this district will be better than that of last year both as to quantity and quality of grain and straw. Average yield, from 36 to 40 bushels; seed sown, from 3 to 3½ bushels.

Barley.—This crop is decidedly better than that of last year both as to quantity and quality. Average yield, from 36 to 40 bushels; seed sown, from 2½ to 3½ bushels.

Oats.—An average crop as to yield, and quality of both grain and straw above average. Average yield, from 36 to 44 bushels.

Harvest in this quarter began about ten days before the usual time, and the weather being favourable, the greater part of the crop was secured in excellent order.

Hay.—A full average crop; but clover not so abundant as at one time expected, owing, I think, to the long continuance of wet weather during winter. The weather being favourable for hay-making, the crop has been generally well secured. Average yield, from 2 to 2½ tons. *Meadow-hay*—Very little made in this district.

Potatoes.—The yield this year is very much above the average of last year both as to quantity and quality, with very little disease, some of the new varieties—such as Up-to-Dates, Gartons, British Queen, &c.—yielding immense crops, from 10 to 15 tons. Maincrops not so abundant, but a first-class quality. Average yield, from 6 to 10 tons.

Turnips.—This crop is a very fair one, but much under the average of last year's crop. The braird came away at once, and very little second sowing required; but owing to the long-continued dry weather during summer the yield this year is under an average. Average yield, from 18 to 25 tons.

There was no apparent damage to crops by insects this year, and comparatively little by weeds, which were easily kept down in the dry weather.

Live Stock.—The pastures were of average growth and quality this year, but on some thin dry lands a little burned up by the long continuance of dry weather during summer. Stock of all kinds throve well on the pastures, and cattle and sheep have kept very free from disease of any kind. *Clip of wool*—Would be a good average this year both as to quantity and quality.

PERTHSHIRE (Strathearn District). *Wheat.*—Very little grown. About 30 bushels; quality good; an average crop; 3½ bushels sown. Well harvested.

Barley.—About 38 bushels; quality of both grain and straw very good; about 4 bushels sown. An exceptionally quick and good harvest.

Oats.—About 44 bushels; quality of both grain and straw very good; about 5 bushels sown, and of the newer varieties 6 bushels sown with exceptional results. An exceedingly quick and good harvest.

Harvest early, lasting not more than three weeks in most cases; in some started and finished in a fortnight.

Hay.—Not such a heavy crop as last year. About 1 ton 5 cwt. for ryegrass and clover. Clover did not do so well in most places. *Meadow-hay*—Not such a heavy crop as last year where cut early.

Potatoes.—A very heavy crop, in many instances double the crop of the previous year; from 8 to 12 tons dressed. Practically no disease.

Turnips.—A much better crop than last year; it would average from 15 to 25 tons, and in some cases more. Crop brairded well. Practically no second sowing.

Little or no damage to crops by insects, although the turnip-fly was to be seen. Very little damage by weeds except wild mustard, which is very common in the district, and seemed more so this year.

Live Stock.—Grass did very well, but barely so well as the previous year. Stock throve well and were free from disease. *Clip of wool*—Quality good, and about an average. The pest of maggots was worse this year than it has ever been, and spoiled a good number of fleeces. It seems to be spreading to places where it was practically unknown, and is becoming very serious in the district generally. Hills with much bracken seem to be worst. Does the fly not breed mostly on bare rocky places where the sheep lie constantly, and where there is a large collection of droppings? If so, could these parts of a hill not be sprinkled with ground sulphur and minimise this evil?

PERTHSHIRE (Highland District). *Wheat.*—None sown.

Barley.—27 bushels; weight, 52 lb., and grain good. Straw much better than last year. 4 bushels sown.

Oats.—Lea, 40 bushels; weight, about 41 lb. Clean land, about 39 bushels. Straw was bulky, but in a good many cases not of extra quality.

Harvest somewhat later than last year, but generally the crop was well secured. On some parts of high ground the crops were not so well secured.

Hay.—The same as last year in every way. The aftermath was good, and slightly better than last year. *Meadow-hay*—Crop more productive than last year. Quantity and quality very good in early places, but in late places it was not well got.

Potatoes.—About $3\frac{1}{2}$ tons. Little or no disease. Bulbs small. Up-to-Dates heaviest crop, but not quite so free from disease as other varieties.

Turnips.—20 tons. On higher ground the weight would be about 18 tons. Very little second sowing. Turnip crop the best average crop of the season.

Few insects. Crops suffered slightly from turnip-fly and frost. Few weeds.

Live Stock.—Pasture was good. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—Quality good, but slightly under the average.

FORFARSHIRE (Western District). *Wheat.*—44 bushels; 3 to 4 bushels where sown by hand.

Barley.—40 bushels; 3 to 4 bushels where sown by hand, 3 bushels where drilled.

Oats.—60 bushels; 4 bushels sown. Oats are yielding well this season.

Harvest began about ten days earlier than usual.

Hay would yield on an average about 2 tons. Well mixed, and of first-class quality.

Potatoes were a splendid crop—just about double last year's yield, which was a good deal under an average. Disease showed itself in several places, but to a limited extent.

Turnips.—The crop would be from 2 to 8 tons under last year's. As a rule, they brairded well, and very little second sowing took place; but there has been a good deal of dry rot and a fair amount of finger-and-toe.

Not much damage by insects, certainly not more than usual. Not much damage by weeds.

Live Stock.—Pastures just about an average, unless on some very dry

sandy hillocks. Stock did fairly well. Cattle and sheep free from disease. *Clip of wool* would be rather over an average.

FORFARSHIRE (Eastern District). *Wheat.*—40 bushels of fair quality. Owing to wet and late sowing, in some instances thin on ground and straw deficient. 4 bushels sown.

Barley.—40 to 48 bushels; excellent quality and weight; straw under average; 4 bushels sown.

Oats.—45 to 50 bushels; good quality and average straw except on light soils near seaside; 4 to 6 bushels sown.

Harvest began 15th August against 21st year before. Weather good, and crops saved in excellent condition.

Hay.—4 to 4½ tons good mixed hay, and mostly saved without damage. *Meadow-hay*—None in district.

Potatoes.—A heavy crop; average from 8 to 12 tons. Very little disease, but second growth noticeable in some varieties. Quality excellent.

Turnips.—Not so heavy as last year—from 15 to 25 tons. Good deal finger-and-toe. Brairded well, but dry season checked growth a good deal.

No injury by insects. No injury from weeds to any great extent.

Live Stock.—Fair pasture, but dried up for want of moisture. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—Average.

ABERDEENSHIRE (Buchan District). *Wheat.*—Not grown in this district. The *Barley* and *Bere* crops were good as regards straw, but the out-turn is not as satisfactory as was anticipated. The yield would be from 36 to 40 bushels, and generally the weight from 53 to 56 lb. per bushel, not much of it coming up to the last weight. Quantity sown, from 3 to 5 bushels.

Oats.—A good crop after lea; but after turnips the crop was light, and generally not a good out-turn. The yield would be on an average from 32 to 38 bushels, and the weight from 38 to 42 lb. Quantity sown, about 5 to 6 bushels. The straw secured early was in excellent order, but anything secured after the rainy weather was a good deal discoloured. Straw will not be over plentiful.

Harvest commenced about the middle of August, and was general by the end of the month. From a week to a fortnight earlier than last year.

Hay.—A general average crop as to quantity, and anything early cut was secured in good order; anything late cut was subjected to rain and heavy mists before being got in, hence colour and quality was a bit spoiled. The weight would run from 32 to 40 cwt. *Meadow-hay*—None grown.

Potatoes.—Very luxuriant as to shaws, and have turned out a good fair crop and generally free from disease.

Turnips.—This crop may be classed as above an average on both as regards swedes and yellows, especially yellows. Swedes, from 16 to 20 tons; yellows, 18 to 22 tons. Scarcely any resowing had to be done.

No damage by insects, and fine cleaning weather, although weeds appeared in some fields in the autumn.

Live Stock.—Pasture very abundant in early part of season, although during the warm weather some of it got a little burned up, yet in most places there was sufficient grass through the season. Live stock did not make so much progress as in some years. No disease. *Clip of wool*—An average.

ABERDEENSHIRE (Formartine District). *Wheat.*—None grown.

Barley.—Last year, 32 bushels; this year, 36 bushels, with an average bulk of straw. The bushel weight is about 55 lb., 1 lb. heavier than last

year. The grain is generally of very fine quality. Seed sown, 4 to 4½ bushels.

Oats.—Last year, 36 bushels; this year, 42 bushels. Straw, 15 per cent under average; seed sown, 5½ to 7 bushels. Quality of grain and straw very good.

Harvest began about the usual time.

Hay.—"Seeds"—*i.e.*, ryegrass and clovers mixed—are cut for hay, and yielded about the same weight as last year of far better quality—viz., 32 cwt. *Meadow-hay*—Almost none grown here.

Potatoes.—Last year, 3½ tons; this year 5 tons. Of superior quality to last year's crop.

Turnips.—Last year, 15 tons; this year, 18 tons. Of better quality than last year's crop. The crop brairded well, and little resowing was done.

Not much damage from insects. Less than the usual damage from knot-grass and couch-grass, owing to the fine dry season for cleaning the land.

Live Stock.—Pastures were very good both in growth and in quality. Stock throve well on them. Cattle and sheep free from disease.

Aberdeenshire (Strathbogie District). *Barley* generally was a good crop as regards straw, which was of good quality. Owing to the brilliant sunshine and excessive heat which prevailed about a month before harvest the grain was hastened to the reaper, and consequently, was not so heavy as expected. The average weight may be stated as ranging round 54½ lb. per bushel, and the average yield about 35 bushels.

Oats gave a most disappointing return in straw, and the crop bulked less in the stackyard than it has done for many years. Indeed some farmers maintain that they have not been so short of straw since the memorable crop of 1868. As a consequence fodder will be remarkably scarce before the commencement of the grazing season, and already those who are in a position to spare can secure high prices. The return of grain has generally been unsatisfactory. This has no doubt been partly caused by a high wind which prevailed for three days about a week before harvest.

Harvest began about ten days before the usual time, and the weather was good throughout.

Hay.—The crop was not up to average as regards quantity. The weather during the curing season was satisfactory, and the quality was therefore good. Clover was fairly abundant. Within the past ten years there has been a manifest increase in the quantity of clover grown in Strathbogie. This is probably owing to the increased use of potash salts in the artificial manures used.

Potatoes.—The yield was satisfactory, and generally considerably over last year. The warm dry season suited the maturing of the tubers, and the quality cannot be surpassed.

Turnips came quickly to the hoe, and there was not any trouble experienced by fly or other insects. The dry season caused gumming, and setting began earlier than usual, consequently the crop is not so heavy as an average. The roots are of good feeding quality.

Live Stock.—Pastures were abundant during the season, but by the middle of the grazing season became remarkably dry and not so succulent as usual. Owing to the excessive heat which prevailed during the summer season cattle did not settle, but ran a good deal through the fields. This increase of exercise and the dry herbage were no doubt the causes of them not thriving so well in the fields as we reasonably expect them to do. Butchers complained of fat animals not weighing nearly up to the average of the grass. There was no disease of any kind prevalent

in the district. *Clip of wool*—The quality was average, but sheep-farmers have had great reason to complain of the prices. The price of all kinds of wool grown in this district has touched the lowest point on record.

BANFFSHIRE (Lower District). *Wheat.*—None.

Barley.—An average crop; 36 bushels average yield; quality good; quality better than last year; seed, 4 bushels.

Oats.—40 bushels average yield; quality of both straw and grain better than last year; seed, 5½ bushels.

Harvest began earlier than usual, about fortnight earlier than last year.

Hay.—Quantity less; quality superior to last year. Mixed clover and ryegrass only yield about 2 tons. *Meadow-hay*—None.

Potatoes.—Yield superior to last year; no disease; about 5½ tons.

Turnips.—Quality and quantity inferior to last year; weight average about 15 tons. Crop brairded rapidly. Little second sowing.

No damage through insects. Weeds no special feature.

Live Stock.—Pastures suffered from drought. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—A fair average.

BANFFSHIRE (Upper District). *Wheat.*—None grown.

Barley.—Yield rather variable. On heavy loamy soils, 5 to 6½ quarters; weights, 55 to 57 lb. per bushel: lighter soils, from 3½ to 5 quarters; 53 to 55 lb. only. From 3 to 5 bushels of seed.

Oats.—Generally light crop, particularly on clean land. Lea fields produce from 3½ to 5½ quarters, according to soil; seed used in proportion, from 5 to 7 bushels; straw well ripened, but a good third under average.

Harvest from two to three weeks earlier, consequent after drought and heat in July and first half of August.

Hay.—Better average crop than last year; good mixture as to ryegrass and clover; quantity from 28 cwt. to 2 tons. *Meadow-hay*—None gathered in these areas.

Potatoes.—Fine crop and fine quality, but only grown for home consumpt. Weights not easily ascertained. No disease. Common field varieties used, Champions prevailing.

Turnips.—Heavier than last year and better quality. Good soils and liberal manuring have 30 tons and over, while many fields would rule under 20 tons. No trouble in brairding.

Slight appearance of some kind of moth under turnip leaves with dry weather in September, but little material damage. The dry season allowed weeds to be kept under with ordinary labour, a great advantage now that wages rule so high.

Live Stock.—Pastures were most luxuriant for six weeks,—June and half July,—then the dry heat tended to shorten them. Stock throve moderately well; a little affected about the middle of the season when grass dried up. Happily no disease. *Clip of wool*—Quite average clip and quality. Sheep were well wintered last season, and the hill pastures came out in time.

MORAYSHIRE. *Wheat.*—Not much grown. Average crop, 37¼ bushels, a half bushel more than last year. Quality of grain better than last year. Straw also better and well harvested. Seed, from 3 to 4 bushels.

Barley.—Average, 30¾ bushels, being 2 bushels less than last year. Quality very much inferior, and about 2 lb. per bushel below the average weight. Owing to the excessive drought, especially for a week about the middle of July, hastened the crop, and did great damage to yield, weight, and quality, especially on dry land.

Oats.—Average, 36¾ bushels, being 2½ bushels less than last year. Owing to the dry month of July this crop was short of straw throughout

the county, especially on dry land; but owing to the superior fine harvest weather, the quality of straw and colour of grain are excellent.

Harvest began about a fortnight before the usual time, say about the 10th of August general.

Hay.—This crop is about the same as last year in quantity, 27 cwt., but quality in some parts very much better where secured before the rain, which lasted for some time at hay-making and did great damage. *Meadow-hay*—Scarcely any grown.

Potatoes.—A fair good crop. Average about 5 tons 18 cwt., being 6 cwt. more than last year. Quality good, and free from disease. Chiefly the usual kinds- Bruce, Sutton's Abundance, Maincrops, and Up-to-Dates, &c.

Turnips.- 16 tons 2 cwt., being 1 ton 10 cwt. less than last year. The dry weather during harvest worked against this crop. At one time it gave great promise of a heavy crop. Although the average of the county comes out at 16 tons 2 cwt., yet on deep soil the crop on some places was very good, as shown by the nitrate competitions, weights running from 36 tons to 43 tons 17 cwt. Brairded well, and not much finger-and-toe.

Not much injury by insects; a little wireworm less than usual. On properly managed farms the crops were not injured by weeds.

Live Stock.—On the light lands of Morayshire the pastures were to a certain extent checked in growth by drought during the months of July and August, and were therefore a little under an average of last year. Stock throve very well, but the pasture should have carried a fourth more stock but for the dry season. Cattle and sheep have been free from disease. *Clip of wool*—A full average both in quantity and quality

NAIRNSHIRE. *Wheat.*—None grown.

Barley.—28 bushels; grain very light; straw fair quality, but short in bulk.

Oats.-- 34 bushels; grain fair quality; straw very short.

Harvest about ten days earlier.

Hay.—Fair quality, and got in in good condition. *Meadow-hay*—None grown.

Potatoes.—Yield fully over last year. A little disease in early sorts.

Turnips.—Over last year. Brairded well; no second sowing. A good deal of canker in some fields.

No injury by insects.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve fairly well. Cattle and sheep were free from disease.

INVERNESS-SHIRE (Inverness District). *Wheat.*—From 3 to 4 bushels sown; yield about 4½ quarters, equal 36 bushels. Crop about an average one, but there is very little wheat sown in the county.

Barley.—Average on best land about 34 bushels; average weight about 54 lb. per bushel; quantity sown about 4 bushels. Both quantity and quality under an average.

Oats.—An average crop. Average yield on best land about 40 bushels; quality of grain excellent, weighing from 42 to 46 lb. per bushel; quantity sown, from 4 to 5 bushels.

Harvest was earlier than average, and was an excellent one throughout.

Hay.—The crop was about an average of former years; quantity from 1½ ton. *Meadow-hay*—None in lower district made.

Potatoes.—The crop was a large one, being above an average yield. A little disease manifested itself before lifting, and since pitted they have become worse. Several new varieties have been planted with good results.

Turnips.—This was an average crop on best cultivated land, but some finger-and-toe prevailed. The crop brairded well, and no second sowing was necessary.

No injury by insects. Wild mustard or charlock was prevalent on some land, and it was tedious to have ground cleaned for turnips, weeds being unusually plentiful.

Live Stock.—Pastures during the season of average growth and quality with last year. Stock throve very fair, but they consumed it without any profit. Cattle and sheep were free from disease. *Clip of wool*—Fair average quantity and quality.

INVERNESS-SHIRE (Skye). *Wheat.*—None grown.

Barley.—None grown.

Oats.—A light crop, except on low-lying and moist land; 6 bushels usually sown.

Harvest began about the usual time.

Hay.—An average crop on the deep low-lying land, but light where most affected by the early summer drought. *Meadow-hay*—About the same as last year.

Potatoes.—A fairly good crop. Disease not prevalent.

Turnips.—Over the average as regards both weight and quality. Only one sowing.

No injury by insects or weeds.

Live Stock.—Pastures during the season of average growth and quality with last year. Stock throve well. A considerable amount of sturdy and louping-ill among young sheep in spring and early summer. There has also been a marked increase for the last two or three summers in the number of sheep "struck" by fly. *Clip of wool*—A good clip; over the average as to weight and quality.

INVERNESS-SHIRE (Lochaber District). *Wheat.*—None grown.

Barley.—Very little grown.

Oats.—About 35 bushels; straw rather short, but quality both of grain and straw better than last year.

Harvest began about ten days earlier than usual.

Hay.—Weight about 1 ton. *Meadow-hay*—Less than last year, owing to dryness.

Potatoes.—Yield about 8 tons; no disease, capital quality. No new varieties.

Turnips.—Weight about 16 tons; quality better than last year. Brairded well, and no second sowing was required.

No injury by insects. No special injury by weeds.

Live Stock.—Pastures rather above average. Stock did well and were quite free from disease. *Clip of wool*—Bulk and quality alike good; rather over average.

ROSS-SHIRE (Dingwall and Munlochy District). *Wheat.*—Quantity of grain and straw average; seed sown, 4 bushels. Very little wheat grown in district.

Barley.—Quantity of grain and quality much below average, owing to very hot weather early in July; quantity of straw about average; seed sown, about 4 bushels; yield, 32 bushels.

Oats.—Quantity of grain and quality below average, also of straw; yield, 38 bushels.

Harvest began 9th August, or ten days earlier than average.

Hay.—Quantity of both ryegrass and clover fully average; quality much deteriorated, owing to wet weather after 19th July; weight, say 1½ ton. *Meadow-hay*—None made.

Potatoes.—Crop about average, say 6 tons. Very little disease.

Turnips.—Weight of swedes over average, 15 to 30 tons; yellows also, 8 to 20 tons. Generally brairded well; very little resowing.

No injury by insects to any extent. No injury by weeds.

Live Stock.—Pastures during the season were of average growth and quality with last year. Stock throve well, and cattle and sheep were free from disease. *Clip of wool*—Average.

Ross-shire (District of Tain, Cromarty, and Invergordon). *Wheat.*—36 to 38 bushels; good weight; seed, 3½ to 4 bushels.

Barley.—Very inferior crop, threshed out badly, 30 to 32 bushels; caused by high wind early in season and too rapid ripening. Seed, usual.

Oats.—Full average crop of good quality; 44 to 46 bushels; seed, 3½ to 4 bushels.

Harvest began a little earlier, from 15th to 20th August.

Hay.—1¼ to 1½ ton; good quality when cut, but got very bad weather. *Meadow-hay*—None grown in district.

Potatoes.—Very irregular. Some kinds did very well, others badly. No disease. No very new varieties grown.

Turnips.—Variable; not so good as last year on the whole, unless on warm land. A good deal of finger-and-toe. Came well to the hoe.

Little spoilt with insects. Not much spoilt by weeds this year.

Live Stock.—Pastures fully average growth and quality. Stock did well. Very free from disease. *Clip of wool*—Barely average.

Sutherland. *Wheat.*—None grown.

Barley.—32 to 36 bushels; straw below average; 3½ bushels.

Oats.—34 to 40 bushels; variable crop; straw light; 4½ to 6 bushels.

Harvest began earlier than usual.

Hay.—Crop similar to last year; 1½ to 1¾ ton. *Meadow-hay*—more; above average, and well secured.

Potatoes.—Above last year; 6 to 8 tons; no disease.

Turnips. Better than last year; 12 to 20 tons.

No injury by insects. Not beyond usual weeds.

Live Stock.—Pastures on the whole better than last year. Stock throve well and were free from disease. *Clip of wool*—Slightly above average. Prices extremely depressing.

Caithness-shire. *Wheat.*—Not grown.

Barley.—Very inferior crop; 30 to 32 bushels; very thin on the ground, and light; weighed about 48 lb; straw very short.

Oats.—A fair crop, but short of straw owing to the continued dry weather during summer; grain good quality; crop about 4 quarters.

Harvest began about first week of September and continued uninterruptedly until the close.

Hay—Clover hay a poor crop, but of good quality. *Meadow-hay*—A good crop, and well saved.

Potatoes.—An average crop, yielding about 4½ tons of good quality. No disease. No new varieties in this district.

Turnips.—A much better crop than last year; about 22 to 24 tons. It brairded well, and came to hoe very quickly; strong healthy plants. There was not more than one sowing required.

No injury by insects or weeds.

Live Stock.—Pastures better quality than last year. Stock throve fairly well, especially sheep. Cattle and sheep have been free from disease. *Clip of wool*—An average quality.

ORKNEY. *Wheat.*—None grown.

Bere.—The average yield was about 32 bushels, weighing about 46 lb. both quantity and weight being less than last year ; seed sown, 3½ to 4½ bushels.

Oats.—A good average crop of both grain and straw ; quality of grain better, but quantity less than last year; average, 30 bushels, weighing 39 lb. ; seed sown, 4 to 6 bushels.

Harvest began in the second week of September, being about the usual time.

Hay.—There was a good quantity made, and seemed in good order ; weight about 23 cwt.

Potatoes.— A poor crop ; small and some disease ; about 3½ tons.

Turnips.—A fair good crop ; brairded and grew well until 7th October, when a gale withered the shaws and checked growth ; weight about 11 tons.

Very little damage done by insects. Not more damage than usual done by weeds.

Live Stock.—Pastures got a good start early in May, and were good, especially the clover, all season. With exception of some cases of founder, caused by cattle eating frosty grass in May, stock have been free from disease and have thriven well all season. *Clip of wool*—Under an average.

SHETLAND (Lerwick District). *Wheat.*—None grown in the county.

Barley.—Grain is better both in quantity and quality. Straw about the same as last year.

Oats.—Both grain and straw slightly inferior to last year.

Harvest began a week before the usual time.

Hay.—Quantity and quality of both ryegrass and clover rather better than last year. *Meadow-hay*— Less productive than last year, but quality better.

Potatoes.—The yield was not equal to last year. There was no disease. No new varieties planted.

Turnips.—Both in weight and quality the crop was better than last year. It brairded well, and only required one sowing.

No damage done by insects. Damage less than usual by weeds.

Live Stock.—Pastures rather under the average ; quality equal to last year. Stock throve fairly well. No disease. *Clip of wool*—The quality was very good, and rather over an average in weight.

THE METEOROLOGY OF 1901.

The following table gives a comparison of the winds, mean pressure, temperature, rainfall, cloud, and sunshine for 1901 as compared with the average of the forty-five years from 1856 to 1900:—

	Direction of Winds—Days.									Wind Force.	Barometric Pressure.	Temperature.	Rainfall.	Cloud.	Sunshine.
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms.	lb. per sq. ft.	inches.	°	inches.	per cent	hours.
Jan. .	1	-1	1	1	-1	-2	0	0	0	0·14	0·082	0·6	-0·89	3	- 15
Feb. .	4	1	-1	-2	-2	-4	1	2	1	-0·63	0·203	-2·4	-0·99	0	- 7
March .	1	2	2	0	-1	-2	-1	-1	0	0·19	-0·041	-0·9	-0·41	3	- 19
April .	-1	-1	-1	0	1	1	1	0	0	-0·09	-0·151	0·5	0·68	-4	5
May .	0	0	3	0	0	-2	-1	-1	1	-0·46	0·185	2·4	-0·33	-9	40
June .	1	-1	-2	-1	1	0	2	1	-1	0·63	0·019	-1·1	0·32	2	- 14
July .	0	1	1	1	0	-1	-1	-2	1	-0·26	0·135	4·6	-1·30	-8	13
August	0	-1	-1	0	1	0	1	1	-1	0·29	0·062	0·9	0·56	0	5
Sept.	0	0	2	3	2	-2	-3	-2	0	0·13	0·017	2·0	-1·14	4	- 12
Oct. .	-1	-1	0	0	2	-1	0	0	1	-0·28	0·054	-0·2	0·15	-5	- 18
Nov. .	0	1	-1	-1	-1	-2	2	1	1	-0·10	0·242	0·2	-0·28	-4	4
Dec.	0	1	1	-1	0	-2	1	2	0	0·27	-0·304	-1·6	0·58	-4	- 5
Year .	5	1	2	0	2	-17	2	1	3	-0·02	0·042	0·4	-0·25	-2	- 23

JANUARY.—The mean temperature was 37°·8, or 0°·6 above the average, the excess being equally divided between the days and the nights. Over south-western and south-eastern districts temperature was slightly under the average, whereas it was fully a degree above it north of the Grampians. The last week was the coldest, when at Aberdeen and Leith temperature was 3°·0 under the average. The highest temperature, 57°·7, occurred at Glencarron, and the lowest, 15°·6, at Braemar.

The mean rainfall was 2·97 inches, or 23 per cent less than the average. It was above the average in a few scattered districts in the counties of Aberdeen, Banff, Inverness, Sutherland, and Orkney; but the excess was small except at Logie-Coldstone, where it exceeded the average by 67 per cent. In all other parts of the country it was short of the average, the deficiency being generally from a third to a half the average. The first half of the month was dry, but wet and stormy weather prevailed during the rest of the month.

FEBRUARY.—The mean temperature was 35°·9, or 2°·4 less than the average, the days being 2°·1 and the nights 2°·7 under the average. It is seen from the table that the direction of the

winds was very abnormal, winds from the cold quarters—N.E N., N.W., and W.—having prevailed eight days more than the average of the month. The lowest temperature occurred over eastern districts south of the Grampians. On the other hand, in the west near the sea, from Islay northwards, temperature was generally less than a degree under the average. A marked feature of the weather of the month was the continuously low maximum temperatures which prevailed, temperature not rising above 45°·0 on any day at many of the stations. The highest temperature was 57°·8 at Lairg, and the lowest 0°·5 at Braemar.

The mean rainfall was 2·06 inches, being 33 per cent under the average. It was above the average to the east and north of a line drawn from Holborn Head to Invershin, Drumnadrochet, Kingussie, and Aberdeen. The greatest excess, about 50 per cent, being at Wick, Tarbet Ness, Gordon Castle, Kingussie, and Logie-Coldstone. Everywhere else the rainfall was under the average, the greatest deficiency, upwards of 70 per cent, being in inland situations south of the Grampians. South of the Grampians nearly the whole of the rain fell in the last week, but to the north the weather of the whole month was wet and cold, the prevailing northerly winds bringing rain in the north, but after crossing the Grampians they were dry winds.

March.—The mean temperature was 38°·5, or about a degree under the average, the diminution of temperature being equally distributed between the days and the nights. The deficiency of temperature was nearly equally distributed among all the districts of Scotland—a uniformity seldom occurring. The last week was the coldest of the month, the mean temperature of which was 8°·0 under the average at Glasgow and Aberdeen. The highest temperature was 64°·0 at Aberdeen, and the lowest 1°·0 at Braemar.

The mean rainfall was 2·43 inch, or 14 per cent less than the average. Its distribution over the districts was very irregular. It was above the average over the slopes extending from the Grampians to the Moray Firth, the excess being chiefly due to the heavy falls of snow. At Inverness and Logie-Coldstone the excess was about 50 per cent. Over the other districts of Scotland the rainfall was less than the average, but the deficiency was nowhere great. The larger portion of the precipitation occurred everywhere during the first week, and to the north of the Grampians the third and fourth weeks were characterised by frequent falls of rain and snow.

April.—The mean temperature was 44°·7, or half a degree above the average, the days being 1°·6 above it, but the nights 0°·5 under it. Hence the higher temperature of the

month was wholly caused by the relatively higher temperature of the days, owing to the greater dryness of the air and the strong sunshine which prevailed. Over a rather broad band, extending from the Grampians to the Firth of Tay and westwards to Loch Linnhe, temperature was about half a degree under the average. Over the rest of Scotland, temperature exceeded the average, the excess being fully a degree in the southern Highlands, along the south shore of the Moray Firth, and about two degrees in Shetland. The highest temperature was 76°·9 at Glasgow, and the lowest 20°·8 at Tillypronie.

The mean rainfall was 2·90 inches, or 31 per cent in excess of the average. Its distribution over the country was extremely irregular, being under the average between the Firth of Forth and the Tweed, and in the counties of Aberdeen, Banff, Elgin, Nairn, Ross, and the northern half of Inverness. The greatest deficiency in the east was 42 per cent at Smeaton, whereas at several stations in Inverness-shire the deficiency exceeded 50 per cent. In all other districts of Scotland the rainfall exceeded the average, the greatest excess—in many cases more than 50 per cent—being in the counties of Shetland, Orkney, Caithness, Argyll, Lower Strathclyde, and Galloway. The greatest excesses were, in percentages, 100 at Bressay, 80 at Wick and Campbeltown, 76 at Glenlee, and 65 at Wolfelee. Nearly the whole of the rain fell from the 1st to the 18th, and from the 27th to the 29th. Very heavy falls were recorded on the 2nd and 3rd, amounting on the 2nd to 2·76 inches at Stronvar, 2·45 inches at Glenlee, 2·35 inches at Greenock, and 2·26 inches at Lednathie; and on the 3rd, 2·04 inches at Ochtertyre, and on the same days upwards of an inch fell at numerous stations. Snow was of occasional occurrence during the first half of the month; and thunderstorms were reported on the 9th and 10th.

MAY.—The mean temperature was 51°·4, or 2°·4 above the average, the days being 4°·7 and the nights 0°·2 above the average. Thus the high temperature was wholly due to the greater heat of the days, the general type of weather being anticyclonic, with the accompanying clear skies, dry air, and strong sunshine. The increase was much greater in the west than in the east. Thus while at many places on the east coast the excess was less than a degree, in the west it was upwards of 4°·0 at a number of places. The absolutely highest temperature was 80°·0 at Poltalloch, and the lowest 27°·0 at Wolfelee.

The mean rainfall was 1·96 inches, or 14 per cent under the average. It was above the average in parts of the counties of Dumfries, Berwick, Perth, Aberdeen, Ross, and Sutherland, but in all cases the excess was small. In all other districts the rain-

fall was under the average, the largest deficiency being at the more western stations, amounting at several places to upwards of 70 per cent, and over extensive breadths to upwards of 50 per cent. Nearly the whole of the rain fell from the 5th to the 11th and from the 26th to the end of the month. The rest of the month was exceptionally dry and rainless.

JUNE.—The mean temperature was 53°·8, or 1°·1 less than the average, the days being 0°·7 and the nights 1°·5 colder than the average. Temperature was nearly half a degree above the average from Bell Rock to the Tweed at coast stations. In all other parts of the country it was under the average, the greatest depression—about 2°·0—being in strictly inland situations in the counties of Inverness and Aberdeen in the north, and Ayrshire and Galloway in the south. The highest temperature was 80°·3 at Loanhead, and the lowest 33°·5 at Leadhills.

The mean rainfall was 2·90 inches, or 12 per cent above the average. It was below the average to the east of a line passing from Peterhead through Logie-Coldstone, Lednathie, Dollar, North Esk Reservoir, and Wolfelee; and also on the west coast from Turnberry to Corsewall, but in almost every ease the deficiency was small. Over all other parts of Scotland the rainfall exceeded the average. The greatest excess was in Orkney and Caithness, amounting to upwards of 100 per cent at several places. It was also large in Strathspey and in Easter Galloway. Little rain fell from the 6th to the 9th, 14th to the 16th, and 25th to the end of the month.

JULY.—The mean temperature was 61°·8, or 4°·6 above the average, the days being 5°·7 and the nights 3°·4 in excess of the average. This forms a record temperature for July, the highest previously being 60°·4 in 1868. Going back on old records from 1764, there occurs only one July—viz., 1779—which exceeds the above, the mean temperature then being 65°·7, which exceeds the mean July temperature of London. The excess was considerably greater in the south than in the north, and at inland situations than near the coast. Reducing the mean temperatures to sea-level, the highest are Kingussie, 64°·8, and Braemar, 64°·7, these being in strictly inland situations. The type of weather was peculiarly anticyclonic, with much strong sunshine. Thunderstorms were of frequent occurrence from the 14th to the 27th. The highest temperature, 91°·0, was observed at Dumfries, and the lowest, 37°·0, at Glencarron.

The mean rainfall was 1·85, or 41 per cent under the average. At places near the sea, from Dunrobin to the mouth of the Spey, the rainfall was above the average, the greatest excess being 52 per cent at Gordon Castle, where on the two days, the 25th and

26th, there fell 3·41 inches. In every other part of Scotland the rainfall of July was under the average, the greatest deficiency being south of a line drawn from Aberdeen to Monach. Over Galloway generally the amount collected was only about a fourth of the average. A marked feature of the meteorology of the month was the frequency of widespread fogs from the 3rd to the 11th and 19th to the 30th.

AUGUST.—The mean temperature was 57°·5, or 0°·9 above the average, the days being 1°·4 and the nights 0°·3 above the average. Over the whole of the eastern slope of Scotland, and also in Galloway and the counties of Lanark, Dumbarton, Orkney, and Shetland, temperature was above the average, the greatest excess, about 2°·0, being in inland districts from Inverness to Edinburgh. On the other hand, in strictly western districts from Cape Wrath to the Solway, temperature was about half a degree under the average, owing to an increased prevalence of westerly winds, viewed in connection with the anticyclonic type of weather which prevailed. The highest temperature was 82°·0 at Inverness and Smeaton, and the lowest 35°·0 at Kingussie.

The mean rainfall was 4·18 inches, or 15 per cent above the average. The weather of the month was noted for the frequency of thunderstorms, and as these were accompanied with downfalls of rain over restricted areas, the distribution of the month's rainfall was extremely irregular. Most rain fell in Shetland, Orkney, and south of the Grampians, but more particularly in the west from Ardnamurchan to the Solway, the excess at several places being from 50 to 100 per cent. On the other hand, north of the Grampians and east of the Caledonian Canal, and in the counties of Kincardine, Ross, and Sutherland, rain was deficient, the deficiency being about a fourth of the average. From the 26th to the 29th the weather was stormy.

SEPTEMBER.—The mean temperature was 54°·8, or 2°·0 above the average, the excess of the days being 1°·8 and of the nights 2°·2. The least excess of temperature was in the east; but owing to a seven days' excess of south-easterly winds, the excess of temperature gradually increased on advancing to the north-west from 1°·5 at Aberdeen to 3°·0 at Kingussie, Fort Augustus, and Glencarron. The highest temperature was 75°·4 at Loanhead, and the lowest 29°·5 at Braemar.

The mean rainfall was 2·46 inches, or 30 per cent less than the average. In Galloway and the extreme west of Argyllshire the rainfall was a little above the average; but in all other parts of the country it was under the average, the general deficiency being about half the average. The rain fell chiefly

from the 6th to the 10th, 17th to the 20th, and 25th to the end of the month. On the 19th, 27th, and 28th heavy rainfalls are reported from several stations.

OCTOBER.—The mean temperature was 46°·3, or 0°·2 under the average, the days being 0°·6 above and the nights 1°·0 under the average. Temperature was above the average in Shetland, Orkney, and over the south of Scotland south of the Forth and Clyde, the excess in all cases being small. In all other districts in Scotland it was under the average, the largest deficiency, fully a degree, being in central districts from the Ochils to upper Strathspey. At quite a large number of stations temperature did not fall to freezing. The highest temperature, 69°·3, occurred at Dumfries, and the lowest, 23°·3, at Braemar.

The mean rainfall was 4·19 inches, or 4 per cent above the average. It was very irregularly distributed over the country. It was less than the average to the east of a line passing from Wolfelee to Stronvar, Fort Augustus, Glencarron, and Cromarty. The greatest deficiency, about 50 per cent, occurred between the Cheviots and the Firth of Forth. Elsewhere the rainfall was above the average, in certain districts largely so, being 50 per cent in excess in Galloway and Argyllshire. At Cally it was 120 per cent above the average. Taken as a whole, the weather for the month was exceptionally wet and stormy. The disastrous storm of the 5th to the 7th was both widespread and protracted.

NOVEMBER.—The mean temperature was 41°·1, or 0°·2 above the average, the days being 0°·9 above and the nights 0°·5 under the average, the higher temperature of the days being due to the increased sunshine. In the west temperature was about a degree above the average, and in the east nearly the average. But in Shetland and Galloway it was a degree under the average. The highest temperature, 60°·0, was recorded at Airds, and the lowest, 6°·0, at Braemar.

The mean rainfall was 3·56 inches, or 7 per cent under the average. The distribution of this rainfall was unusually irregular. It was above the average on the south shore of the Moray Firth and for some distance inland, and to the south of a line drawn from North Berwick to Campbeltown, except over central Galloway. In other parts of Scotland the rainfall was under the average. The deficiency was greatest over a broad district extending from Skye eastwards through Scotland to the east coast from Aberdeen to Fifeshire. The rain fell chiefly on the second and third weeks, but was heaviest from the 18th to the 21st. The outstanding feature of the weather of November

was the disastrous north-easterly gale of the 12th. The damage to shipping and loss of life on the east coast was very great; and inland there was a complete breakdown of the telegraph wires.

DECEMBER.— The mean temperature was 36°·4, or 1°·6 lower than the average, the days being 1°·8 and the nights 1°·4 under the average. Everywhere temperature was under the average. Generally the cold was least at places near the coast, and greatest at inland stations. The deficiency was nearly three degrees at Wolfelee, Cally, Drumlanrig, Leadhills, Kingussie, Fort Augustus, and Lairg. On the other hand, it was scarcely a degree at eastern coast stations from Orkney to Fife. The highest temperature was 58°·0 at Perth and Airds, and the lowest 9°·5 at Braemar.

The mean rainfall was 4·74 inches, or 14 per cent above the average. It was under the average at some scattered stations in the north-west, and in central Argyll and adjoining parts of Bute, Renfrew, and Dumbarton. In other parts the rainfall was above the average. The excess was 110 per cent in Arran, 89 per cent at Stobo Castle, and 56 per cent at Gordon Castle, but only moderate at other stations. The weather was cold, damp, and disagreeable. A severe snowstorm occurred from the 12th to the 14th, and gales were of frequent occurrence. Snow fell frequently from the 14th to near the end of the month, after which milder weather set in. Thunder occurred on the 8th, 9th, and 19th.

The harvest of 1901 was an early one in all parts of Scotland, including the outlying islands in the west and north. It was from a week to a fortnight, and in some cases three weeks, before the usual time. Fine weather prevailed, so that at many places cutting and storing were carried on uninterruptedly to the end.

Wheat was at least an average crop, but at most places it was well above the average.

Barley and oats were both generally good crops, more particularly south of the Grampians. But from Caithness southward to west of the Spey barley was rather under the average.

Potatoes, except in Shetland and Orkney, were very fine crops, with little or no disease.

Turnips were mostly under an average crop in districts in the east south of the Tay, but elsewhere the turnip crop was a good one.

AGRICULTURAL STATISTICS.—RETURNED UPON 4TH JUNE 1901.—(*Compiled from the Government Returns.*)

TABLE No. 1.—ACREAGE UNDER EACH KIND OF CROP, BARE FALLOW, AND GRASS, IN EACH COUNTY OF SCOTLAND.

Counties.	Total Acreage under Crops, Bare Fallow, and Grass.	Corn Crops.							Green Crops.							Clover, Sainfoin, and Grasses under Rotation.	Permanent Pasture (exclusive of Mountain Land).	Flax.	Small Fruit.	Bare Fallow or Uncropped Arable Land.
		Wheat.	Barley or Bere.	Oats.	Rye.	Beans.	Peas.	Total.	Potatoes.	Turnips.	Mangels.	Cabbage, Kohl-rabi, and Rape	Vetches or Tares.	Other Green Crops.	Total.					
	Acres.	Acres.	Acres.	Acres.	Acres	Acres.	Acres	Acres.	Acres.	Acres.	Acres	Acres.	Acres.	Acres.	Acres.	Acres	Acres.	Acres.	Acres	Acres.
1. Aberdeen	631,015	10	27,628	185,565	308	459	366	214,336	7,477	89,360	4	135	2,287	372	99,635	283,498	32,019	..	368	159
2. Argyll	136,969	1	1,510	17,239	453	89	10	19,302	4,538	5,371	53	206	23	41	10,232	26,893	80,206	..	39	297
3. Ayr	321,305	873	1,651	43,198	168	955	36	46,881	8,193	6,571	669	793	22	225	16,473	99,056	158,634	..	162	99
4. Banff	160,225	11	9,814	47,945	65	149	45	58,029	2,033	22,141	10	14	949	17	25,164	67,379	9,565	2	11	75
5. Berwick	191,358	1,081	20,885	33,815	24	983	62	56,850	2,205	27,384	310	739	614	3	31,255	59,681	43,426	..	33	113
6. Bute	25,961	5	90	4,929	66	74	11	5,175	941	1,446	18	94	5	7	2,511	8,165	9,800	..	40	270
7. Caithness	113,046	7	1,151	33,610	148	2	32	34,950	1,675	13,429	7	44	446	12	15,613	33,366	28,978	..	7	132
8. Clackmannan	15,287	182	492	2,938	6	586	..	4,204	403	781	3	44	19	52	1,302	3,200	6,421	..	23	137
9. Dumbarton	51,524	806	282	6,666	18	123	24	7,919	2,402	1,378	36	234	34	9	4,093	18,125	21,224	..	78	85
10. Dumfries	260,109	105	754	41,512	9	20	3	42,403	3,452	17,496	435	1,328	49	44	22,804	81,786	112,748	..	76	292
11. Edinburgh	131,666	3,536	5,786	23,009	3	78	148	32,560	5,704	11,478	60	1,300	260	354	19,156	33,894	45,712	..	285	59
12. Elgin	101,475	706	13,835	21,428	483	33	26	36,511	1,763	15,222	37	15	397	10	17,444	38,497	8,942	1	23	57
13. Fife	255,446	7,466	23,132	38,872	1,069	1,300	32	71,871	15,252	23,817	39	558	536	50	40,252	66,537	75,920	..	224	642
14. Forfar	250,453	7,086	30,474	48,890	531	550	102	87,633	12,146	33,654	81	331	488	81	46,781	87,219	28,480	1	255	84
15. Haddington	111,773	4,041	16,135	17,670	14	448	87	38,395	7,981	15,347	232	554	251	326	24,691	29,031	19,289	..	348	19
16. Inverness	148,776	88	7,195	30,262	623	7	20	38,145	5,977	10,721	23	38	106	5	16,870	31,388	62,034	..	41	298
17. Kincardine	120,472	393	13,381	27,675	73	533	30	42,085	2,448	17,867	1	45	366	94	20,821	47,838	9,617	..	99	12
18. Kinross	35,372	18	493	6,327	62	45	..	6,945	652	2,667	3	138	38	14	3,512	11,942	12,935	..	16	22
19. Kirkcudbright	191,970	81	35	26,627	22	59	5	26,829	1,526	11,993	147	1,472	18	31	15,187	63,091	86,733	..	28	102
20. Lanark	255,822	1,491	324	36,260	61	671	41	38,848	4,536	9,351	44	1,939	225	313	16,408	87,002	111,012	..	2,174	378
21. Linlithgow	58,658	879	3,434	9,804	19	299	8	14,443	1,849	3,543	12	352	154	8	5,918	17,297	20,878	..	36	86
22. Nairn	25,886	..	3,403	5,473	96	..	3	8,975	354	4,213	6	4	36	4	4,617	10,309	1,966	..	5	14
23. Orkney	107,056	..	4,527	33,554	..	5	27	38,113	2,760	14,579	1	33	313	12	17,698	33,944	17,054	..	..	247
24. Shetland	59,602	..	1,711	7,546	14	..	..	9,271	3,040	1,380	..	545	3	..	4,968	1,414	43,459	..	..	490
25. Peebles	49,483	6	417	7,827	4	..	33	8,287	361	3,943	1	608	45	1	4,959	16,431	19,782	..	20	4
26. Perth	338,658	3,570	15,573	65,427	352	2,029	95	87,046	12,490	28,980	138	513	278	49	42,448	101,775	104,860	..	1,270	1,259
27. Renfrew	91,431	1,304	80	10,509	22	238	6	12,159	3,022	2,166	48	427	12	48	5,723	25,709	47,553	..	156	131
28. Ross & Cromarty	141,061	601	12,597	30,171	667	24	53	44,113	7,374	16,038	84	235	441	24	24,196	43,211	29,296	..	49	196
29. Roxburgh	182,082	289	12,883	28,414	1	256	10	41,853	1,236	21,445	49	809	238	12	23,789	53,822	62,514	..	44	60
30. Selkirk	30,230	..	334	4,821	..	..	10	5,165	184	2,695	1	150	45	..	3,075	8,765	13,204	..	17	4
31. Stirling	118,672	1,347	3,127	17,808	48	2,811	11	25,152	3,146	4,188	27	350	232	98	8,041	32,044	52,372	..	128	935
32. Sutherland	32,738	..	1,264	7,887	89	3	10	9,253	1,680	3,015	4	37	46	..	4,782	8,804	9,821	..	..	78
33. Wigtown	154,550	292	718	32,711	23	208	3	33,955	1,376	14,897	367	320	40	68	17,068	62,348	40,770	..	24	385
Total	4,900,131	36,225	235,115	956,389	5,541	13,037	1,349	1,247,656	130,176	458,556	2,950	14,404	9,016	2,384	617,486	1,593,461	1,428,224	4	6,079	7,221

TABLE No. 2.—ESTIMATED TOTAL PRODUCE OF WHEAT, BARLEY, AND OATS, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1900, compared with the Estimated YIELD for the Years 1899 and 1898, and the AVERAGE of the Ten Years, 1890-99, in each COUNTY of SCOTLAND.

Counties.	Wheat.						Barley, including Bere.						Oats.					
	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre. 1900.	1899.	1898.	Average of the Ten Years, 1890-99.	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre. 1900.	1899.	1898.	Average of the Ten Years, 1890-99.	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre. 1900.	1899.	1898.	Average of the Ten Years, 1890-99.
	Bush.	Acres	Bush.	Bush.	Bush.	Bush	Bush.	Acres	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.
Aberdeen	578	17	34.00	30.00	34.33	29 52	982,704	29,619	33 18	33.28	34.84	34.52	6,383,301	182,517	34.97	34.95	33.99	35.19
Argyll	24	1	24.00	40.00	..		48,480	1,635	29.65	27.46	32.63	31.12	512,375	17,349	29.53	30.65	32.31	30 84
Ayr	37,616	976	38.54	39.75	38 74	37.65	63,943	1,661	38 50	41.67	41.59	39.63	1,974,445	44.412	44.46	47.58	46.14	45.30
Banff	1,866	52	35.88	35.96	37.86	31.32	322,181	10,158	31.72	34.21	38.86	35.75	1,799,741	47,367	38.00	35.22	39.28	35.71
Berwick	61,384	1,903	32.26	35.48	39.87	34.24	648,301	21,139	30.67	35.10	41.31	35.88	1,216,933	33,122	36.74	35.30	36.85	37.05
Bute	..	..	..	36.83	38.96	..	5,253	133	39.50	40.72	40.88	39.22	160,202	4,902	32.68	34.61	39.58	34.93
Caithness	60	4	15.00	16.00	..	*13.85	32,683	1,212	26.97	28.14	31.60	32.43	916,682	33,699	27.20	29.35	33.41	32.97
Clackmannan	11,463	282	40.65	39.99	42.12	37.29	15,873	494	32.13	31.40	37 32	35.77	111,858	2,912	38.41	39.01	44.31	43.29
Dumbarton	42,287	1,037	40.78	36.46	41.46	39.03	11,710	289	40.52	40.57	43.04	42.01	247,573	6,704	36.93	37.07	42.23	41.79
Dumfries	5,011	123	40.74	39.51	41.48	36.67	26,284	659	39.88	39.68	39.83	34.83	1,468.905	42,732	34.37	33.45	35.86	33.46
Edinburgh	177,094	4,104	43.15	43.07	49.14	44.13	255,984	6,098	41 98	40.90	48.30	44.02	934,959	22,799	41.01	36.89	42.38	42.93
Elgin or Moray	33,313	886	37.60	37.82	40.74	35.72	462,383	14,141	32 70	32.42	37.99	34.81	788,759	20,421	38.62	35.52	38.56	36 31
Fife	336,765	10,028	33.58	33.60	42.39	34.81	733,621	22,569	32.51	31.65	42.42	34.76	1,483,540	38,665	38.37	34.96	41.13	37.86
Forfar	288,454	8,640	33.39	36.81	40.64	35.42	1,105,875	30,472	36 29	36.36	40.68	37.23	2,194,176	46,817	46.87	37.67	39.99	43.49
Haddington	201,484	5,162	39.03	42.30	45 55	39.12	647,362	16,340	39.62	41.03	47.68	41.95	727,396	16,815	43.26	39.76	43.07	44.64
Inverness	853	36	23.69	24 00	31.38	34 57	181,113	7,526	24.06	25.37	28.88	33 95	868,619	30,048	28.91	29.84	32.08	31.62
Kincardine	29,865	793	37.66	38.48	41.06	36.56	481,733	13,958	34.51	36.64	39.18	36.10	1,092,456	27,189	40.18	39.95	37.91	39.42
Kinross	482	14	34.43	32.37	39.65	*32.77	16,150	482	33.51	31.80	36.06	34.68	197,516	6,261	31.55	27.02	29.62	31.84
Kirkcudbright	1,792	49	36.57	34.50	37.24	32.09	2,096	65	32.25	37.86	38.14	33 13	925,901	27,310	33 90	34.41	35 37	33.65
Lanark	96,916	2,580	37.56	34.30	37 80	36.09	11,872	355	33.44	32.42	34.44	34.92	1,447,612	36,648	39.50	32.71	38.23	35.75
Linlithgow	50,534	1,300	38.87	39.81	49.03	39.97	142,662	3,414	41.79	39.30	50.06	43.43	387,875	9,482	40.91	38.50	42.50	43.29
Nairn	..	..	..	32.00	32.74	31.56	99,641	3,489	28.62	30.04	35.50	35.67	202,118	5,462	37.00	34.15	35.92	35.60
Orkney	..	..	..	..	..	..	155,636	4,594	33.88	33.53	33.26	33.79	968,682	33,392	29.01	28.47	28.90	28.33
Peebles	768	24	32.00	30.86	32.46	†30.98	15,163	436	34.78	30.73	34.15	33.15	278,430	8,036	34.65	31.51	34.01	33.66
Perth	219,361	5,764	38.06	38.59	43 97	36.86	537,676	15,460	34.78	35.30	38.73	34.77	2,157,823	63,731	33.86	33.78	38.50	35.24
Renfrew	64,784	1,583	40.92	38.84	38.62	40 04	2,183	57	38.30	45.35	42.94	43.03	457,625	10,961	41.75	42.90	42.62	43.76
Ross and Cromarty	23,613	789	29.93	30.20	36.23	40.61	396,219	12,707	31.18	31.17	35.76	38.76	931,105	29,868	31.17	31.05	36.25	39.42
Roxburgh	14,997	488	30.73	33 67	38.25	33.16	367.783	13,224	27.81	32.21	41.10	35.32	940,642	28,740	32.73	32.05	36.81	35.01
Selkirk	240	8	30.00	..	36.00	..	9,707	441	22.01	24.03	35.60	30 56	165,920	4,880	34.00	30.00	33.70	32.73
Shetland	..	..	..	..	..	..	44,567	1,746	25.53	26.45	26.04	25.06	185,780	7,526	24.69	25.08	23.82	24.81
Stirling	67,599	1,821	37.12	38.11	42.82	35.89	107,945	3,255	33.16	32.36	37.54	35.66	650,086	17,797	36.53	36.44	41.83	39.70
Sutherland	..	..	..	..	..	..	30,578	1,371	22.30	24 68	28.94	31.82	176,775	7,817	22.61	24.04	27.29	31.23
Wigtown	9,922	368	26.96	27.49	32.82	27.71	29,812	906	29 93	32 83	35.20	31.99	1,049,294	32,747	32.04	34.78	34.65	36.43
Total	1,779,125	48,832	36.43	37.42	42.47	36.98	7,995,373	240.195	33.29	34 19	39.07	36.20	34,005,054	949,128	35.83	34.78	36.87	36.55

* Average of 8 years only.

† Average of 9 years only.

TABLE No. 3.—ESTIMATED TOTAL PRODUCE OF BEANS, PEAS, AND POTATOES, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1900, compared with the Estimated YIELD for the Years 1899 and 1898, and the AVERAGE of the Ten Years, 1890-99, in each COUNTY of SCOTLAND.

Counties.	Beans. Total Produce in 1900.	Beans. Acreage in 1900.	Beans. Average Yield per Acre 1900.	Beans. 1899.	Beans. 1898.	Beans. Average of the Ten Years, 1890-99.	Peas. Total Produce in 1900.	Peas. Acreage in 1900.	Peas. Average Yield per Acre. 1900.	Peas. 1899.	Peas. 1898.	Peas. Average of the Ten Years, 1890-99.	Potatoes. Total Produce in 1900.	Potatoes. Acreage in 1900.	Potatoes. Average Yield per Acre. 1900.	Potatoes. 1899.	Potatoes. 1898.	Potatoes. Average of the Ten Years, 1890-99.
	Bush.	Acres	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush	Bush.	Bush.	Bush.	Tons.	Acres.	Tons.	Tons.	Tons	Tons.
Aberdeen	9,764	*385	25.36	26.63	23.10	24.73	7,155	*330	21 68	21.86	21.18	22.56	30,699	7,373	4.16	4.86	6.91	5.19
Argyll	1,455	78	18.65	17.10	20.26	18.83	299	15	19.93	18.78	19.19	19.53	18,841	4,558	4.13	4.39	4.93	4.69
Ayr	53,231	978	33.98	34.79	36 21	33.63	1,495	43	34.77	34.89	35.29	33.46	49,259	8,340	5.91	6.70	7.04	6 39
Banff	3,503	*113	31.00	28.93	22.46	25.12	762	*35	21.77	22.50	18.22	21.59	11,418	2,007	5.69	5.92	7.35	5.49
Berwick	29,742	858	34.66	34.48	36.06	32.71	1,177	44	26.75	23.93	26.22	25.82	8,171	2,379	3.43	5.41	7.11	6.21
Bute	1,287	62	20.76	22.34	25.98	21.19	178	10	17.80	18.58	19.92	17.90	4,997	974	5.13	5.48	6.83	5.85
Caithness	16	3	5.33	5.00	7.75	8.49	177	36	4.92	9.10	13.67	12.06	9,533	1,658	5.75	6.39	6.29	4.81
Clackmannan	15,401	468	32.91	33.44	33.47	31.69	..	..	..	..	..	—	2,647	407	6.50	7.57	9.38	8.48
Dumbarton	3,107	144	21.58	22.26	24.49	27.14	198	9	22.00	18.00	24.62	18.78	13,596	2,444	5.56	6.84	9.05	7.62
Dumfries	114	4	28.50	30.25	29.17	27.16	148	7	21.14	21.89	22.57	22 45	15,616	3,617	4.32	6.12	6.82	5.92
Edinburgh	2,220	65	34.15	30.56	33.52	33.40	3,917	144	27.20	25.62	27.45	25.56	33,919	5,458	6.21	5.42	7.50	6.64
Elgin or Moray	1,870	62	30.16	30 12	34.83	28.70	354	12	29.50	21.85	28.75	23.52	9,343	1,678	5.57	5.04	5.26	4.82
Fife	36,404	1,104	32.97	36.31	39.62	34.44	1.264	42	30.10	32.47	32.00	29 66	52,169	15,042	3.47	3.99	6.74	4.99
Forfar	21,119	633	33.36	36.93	33.89	32.56	1,928	76	25.37	26.00	26.15	27.73	54,231	12,606	4.30	5.67	7.13	5.54
Haddington	17,600	491	35.85	31 70	35.60	34.33	2,490	85	29.29	25.14	26.77	26.13	44,055	7,750	5.68	5.08	7.48	6.60
Inverness	139	8	17.37	17.60	21.80	†19.57	415	22	18.86	19.19	23.03	24.95	22,235	6,071	3.66	3.83	4.31	4.09
Kincardine	20,874	*557	37.48	38.67	38.57	35.96	1.377	43	32.02	24.79	24.15	26.15	10,413	2,554	4.08	4.62	8.99	6.15
Kinross	909	28	32.46	31.57	36.49	33.07	60	2	30.00	.	.	—	1,992	618	3.22	5.37	6.62	5.78
Kirkcudbright	2,231	73	30.56	28.00	32.71	32.68	173	6	28.83	28.08	30.00	27.01	6,709	1,575	4.26	4.91	5.61	5.25
Lanark	27,862	855	32.59	30.91	32.85	32.66	1,007	41	24.56	25.13	27.21	28.68	30,513	4,446	6.86	6.27	8.21	6.77
Linlithgow	11,433	337	33.93	31.64	34.99	32.62	179	6	29.83	25.00	24.67	25.79	9,549	1,841	5.19	5.36	7.82	6 51
Nairn	..	..	..	..	..	—	..	..	..	21 00	22.00	22.59	1,413	323	4.37	3.96	4.68	4.29
Orkney	..	*..	..	..	..	..	..	*..	..	..	..	..	18,003	2,783	6.47	6.77	7.47	6.60
Peebles	..	..	..	..	..	—	515	21	24 52	23.71	23.69	23.76	2,211	392	5.64	5.08	6.86	6.20
Perth	75,209	2,093	35.93	36.22	37.54	32.95	3,291	87	37.83	30.93	34.38	28 57	52,530	12,884	4.08	5.08	7.51	6.12
Renfrew	9,006	237	38.00	38.45	38.14	40.16	877	25	35.08	36.00	36.52	36.68	17,482	2,994	5.84	7.10	8.14	6.67
Ross and Cromarty	1.729	105	16.47	14.78	18.46	22.63	690	43	16.05	16.52	19.56	23.94	19,617	7,405	2.65	3.20	3.31	4.02
Roxburgh	4,580	165	27.76	31.04	34.73	31.55	1,030	37	27 84	26.61	30.81	27.88	4,801	1,375	3.49	4.77	6.23	5.55
Selkirk	..	..	..	32.00	..	—	384	16	24.00	26.00	30.64	26.73	590	197	2.99	3.99	5.20	4.32
Shetland	..	..	..	..	..	—	..	..	..	..	..	..	11,783	3,046	3.85	4.37	4.06	3.79
Stirling	88,858	2,817	31.54	32.62	35.72	31.17	273	12	22.75	25.80	31.33	26.45	17,147	3,252	5.27	6.49	8.48	7.13
Sutherland	12	1	12.00	11.75	16.80	‡19.91	267	24	11.12	9.35	15.19	19.53	5,361	1,663	3.22	3.60	4.32	3.91
Wigtown	7,124	251	28.38	32.26	32.46	30.01	88	3	29.33	30.00	30.62	30.39	4,922	1,490	3.30	3.78	5.01	4.44
Total	426,799	*12,975	32.89	33.66	35.26	32 35	32,168	*1,276	25.21	24.04	25.47	24 77	595,715	131,200	4.54	5.11	6.66	5.60

* Exclusive of 109 acres in Aberdeen, 31 acres in Banff. 1 acre in Kincardine, and 8 acres in Orkney, the produce of which was picked green.
† Average of 7 years only.
‡ Exclusive of 54 acres in Aberdeen, 8 acres in Banff, and 34 acres in Orkney, the produce of which was picked green.

TABLE No. 4.—ESTIMATED TOTAL PRODUCE of TURNIPS (including SWEDES) and MANGELS, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1900, compared with the Estimated YIELD for the Years 1899 and 1898, and the AVERAGE of the Ten Years, 1890-99, in each COUNTY of SCOTLAND.

Counties.	Turnips.						Mangels.					
	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre.			Average of the Ten Years, 1890-99.	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre.			Average of the Ten Years, 1890-99.
			1900.	1899.	1898.				1900.	1899.	1898.	
	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.
Aberdeen	1,097,682	90,346	12.15	12.30	15.48	14.73	96	7	13.71	13.50	6.87	10.75
Argyll	71,501	5,352	13.36	12.36	15.23	13.82	305	43	7.09	8.34	7.87	11.02
Ayr	117,981	6,552	18.01	15.63	18.33	17.33	13,139	677	19.41	17.29	18.60	17.52
Banff	322,248	22,260	14.48	15.09	18.32	15.16	41	4	10.25	8.75	18.50	*13.27
Berwick	470,542	27,322	17.22	11.74	14.34	15.79	4,977	284	17.52	15.45	16.84	18.80
Bute	20,220	1,477	13.69	13.89	17.42	16.56	135	14	9.64	9.09	12.67	12.67
Caithness	158,120	13,746	11.50	14.80	15.86	14.60	11	2	5.50	9.00	13.00	†10.14
Clackmannan	8,040	809	9.94	7.33	10.73	11.52	28	4	7.00	7.00	10.00	10.87
Dumbarton	22,216	1,352	16.43	15.11	19.61	17.61	447	31	14.42	13.76	17.41	15.54
Dumfries	291,834	18,042	16.18	11.35	16.53	14.82	5,825	277	21.03	21.73	22.76	22.00
Edinburgh	230,408	11,722	19.66	11.86	17.80	18.02	989	46	21.50	13.80	18.04	15.46
Elgin or Moray	277,603	15,438	17.98	14.71	17.27	16.06	1,568	68	23.06	17.54	17.33	15.73
Fife	418,181	24,704	16.93	9.32	14.78	12.05	829	51	16.25	20.76	20.39	12.35
Forfar	691,547	34,198	20.22	14.81	16.34	16.38	1,740	83	20.96	30.26	23.18	22.34
Haddington	299,599	15,672	19.12	12.92	16.78	18.39	5,276	251	21.02	15.73	16.69	15.50
Inverness	108,136	10,653	10.15	9.52	10.98	11.31	163	17	9.59	12.09	10.67	14.79
Kincardine	261,728	17,923	14.60	13.21	15.14	15.10	75	5	15.00	14.00	14.67	—
Kinross	47,793	2,795	17.10	7.58	14.54	12.73	4	1	4.00	..	..	..
Kirkcudbright	217,021	12,077	17.97	10.58	18.45	16.22	2,032	103	19.73	17.19	20.20	16.50
Lanark	211,070	9,390	22.48	14.28	21.44	18.80	397	32	12.41	9.31	15.11	12.86
Linlithgow	69,657	3,879	17.96	11.28	16.88	16.72	292	15	19.47	12.92	14.50	12.50
Nairn	71,283	4,193	17.00	13.56	14.81	13.98	120	8	15.00	12.00	12.40	‡14.28
Orkney	140,830	14,564	9.67	10.45	9.16	9.63	..	..	..	§—	§—	‡1.49
Peebles	74,260	4,092	18.15	11.67	16.92	16.52	..	..	..	12.00	14.00	—
Perth	459,767	29,533	15.57	12.36	15.92	14.68	1,181	110	10.74	13.46	13.46	11.22
Renfrew	37,755	2,386	15 82	12.87	18.57	16.61	592	40	14.80	12.79	17.17	15.10
Ross and Cromarty	132,854	16,428	8.09	7.82	10.19	10.69	963	116	8.30	9.12	11.86	16.10
Roxburgh	386,428	21,679	17.82	11.21	13.28	15.48	933	54	17.28	15.69	16.89	20.64
Selkirk	32,358	2,697	12.00	10.00	13.95	13.96	..	..	..	..	..	—
Shetland	20,784	1,376	15.10	18.17	15.88	14.24	..	..	..	..	..	—
Stirling	55,725	4,393	12.68	9.51	14.16	15.04	220	18	12.22	10.67	14.25	13.41
Sutherland	20,072	3,082	6.51	7.70	9 64	9.77	..	..	..	..	..	—
Wigtown	293,710	15,102	19.45	12.30	16.94	14.25	6,430	300	21.43	18.20	18.52	16.02
Total	7,138,953	465,234	15.34	12.23	15.50	14.85	48,808	2,661	18.34	16.87	18.04	16.95

* Average of 9 years only. † Average of 6 years only. ‡ Average of 7 years only. § Crop failed.

TABLE No. 5.—ESTIMATED TOTAL PRODUCE OF HAY from Clover, Sainfoin, and Grasses under Rotation, also Total from Permanent Pasture, ACREAGE, and Estimated AVERAGE YIELD per Acre in the Year 1900, compared with the Estimated YIELD for the Years 1899 and 1898, and the AVERAGE of the Ten Years, 1890-99, in each COUNTY of SCOTLAND.

COUNTIES.	FROM CLOVER, SAINFOIN, AND GRASSES.						FROM PERMANENT PASTURE.					
	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre			Average of the Ten Years, 1890-99.	Total Produce in 1900.	Acreage in 1900.	Average Yield per Acre.			Average of the Ten Years, 1890-99.
			1900	1899.	1898.				1900.	1899.	1898.	
	Cwt.	Acres.	Cwt	Cwt.	Cwt.	Cwt.	Cwt.	Acres.	Cwt.	Cwt.	Cwt.	Cwt.
Aberdeen	1,245,101	46,904	26.55	27.19	32.65	27.01	27,972	1,601	17.47	18.52	22.53	21.41
Argyll	349,951	11,187	31.28	29.59	31.35	29.74	440,904	14,814	29.76	28.68	29.71	28.91
Ayr	1,183,462	32,566	36.34	33.83	36.86	33.54	636,492	16,166	39.37	38.15	39.59	35.80
Banff	252,222	9,342	27.00	24.96	30.62	27.78	3,329	181	18.39	18.29	19.69	20.72
Berwick	330,052	9,984	33.06	27.05	31.34	31.32	43,371	1,569	27.64	24.08	24.29	26.68
Bute	75,141	2,182	34.44	35.87	38.44	34.23	11,148	397	28.08	29.24	32.11	28.70
Caithness	214,868	9,553	22.49	18.16	24.32	26.51	8,071	1,476	5.47	7.23	11.65	14.57
Clackmannan	63,625	1,792	35.50	32.53	39.94	33.57	15,456	656	23.56	25 17	31.04	28.79
Dumbarton	302,516	6,989	43.28	37.79	31.23	35.69	55,714	1,409	39.54	39.11	44.14	38.22
Dumfries	600,839	18,228	32.96	26.22	28.12	25.17	709,004	18,336	38 67	36.17	35.58	28.42
Edinburgh	810,032	13,154	61.58	54.38	58.52	50.06	69,078	2,167	31.88	31.58	35.01	34.01
Elgin or Moray	156,091	5,752	27 14	23.31	28.88	25.53	4,876	242	20.15	18.18	22.34	20.58
Fife	814,294	25,991	31.33	29.73	34.74	30.07	92,735	3,277	28.30	27.05	28.89	26.02
Forfar	786,830	20,551	38.29	38.38	38.13	35.11	35,055	1,459	24.03	20.00	20.11	23.03
Haddington	579,405	10,673	54.29	51.19	53.81	47.89	31,751	1,125	28.22	27.12	29.40	30.99
Inverness	240,910	11,101	21.70	18.69	20.50	18.70	126,322	4,835	26.13	18.34	20.41	13.41
Kincardine	366,974	12,862	28.53	26.92	32.02	28.19	2,632	134	19.64	17.83	24.55	19.32
Kinross	95,387	2,644	36.08	25.13	28.67	26.96	29,757	762	39.05	27.71	35.29	30.72
Kirkcudbright	279,644	9,144	30.58	27.35	31.48	27.09	376,313	12,938	29.09	26.55	27.26	25.51
Lanark	1,354,803	34,509	39.26	30.90	41.71	36.23	347,419	10,033	34.63	31.10	44.24	36.93
Linlithgow	433,669	7,499	57.83	48.47	54.52	44.57	28,846	943	30.59	29.75	29.86	30.53
Nairn	39,503	1,846	21.40	20.95	22.64	20.37	288	18	16.00	16.10	20.65	16.94
Orkney	164,984	8,471	19.48	19.17	18.91	22.27	7,963	*738	10.79	10.14	9 32	8.15
Peebles	74,856	2,313	32.36	30.47	33.42	30.17	44,001	1,277	34.46	29.14	28.71	28.29
Perth	959,992	30,368	31.61	27.48	28.52	30.53	236,328	9,903	23.86	21.30	23.31	24.39
Renfrew	580,176	14,099	41.15	35.71	40.09	37.94	265,807	5,485	48.46	44.19	48.38	44.64
Ross and Cromarty	235,874	13,886	16.99	16.63	18.46	19.41	16,376	2,207	7 42	6.94	7.96	9.47
Roxburgh	303,875	8,637	35.18	27.57	30.91	31.56	203,421	6,264	32.47	25.42	24.32	27.37
Selkirk	32,839	939	34.97	26.00	30 78	28.79	41,910	1,397	30.00	[illegible]	25.25	24.46
Shetland	13,932	767	18.16	20.26	19.31	26.11	25,114	1,576	15.94	[illegible]	15.70	17.37
Stirling	477,424	12,999	36.73	33.89	38.65	32.44	111,332	3,376	32.98	31.89	35.09	30.79
Sutherland	61,813	4,072	15.18	15.21	18.09	18 39	9,731	1,219	7.98	7.42	8.80	10.71
Wigtown	182,679	5,219	35.00	32.51	34.00	36.00	82,311	3,732	22.06	19.86	19.83	24.08
Total	13,663,763	406,223	33.64	30.20	34.21	31.05	4,140,827	*131,712	31.44	29.03	30.89	28.34

* This Acreage is less than that stated in some other Tables by 44 acres, which were originally returned for the county of Orkney as "Grass for Hay," but were subsequently stated to have been used for grazing.

TABLE No. 6.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS IN EACH COUNTY OF SCOTLAND AS RETURNED ON JUNE 4, 1901.

Counties.	Horses (including Ponies). Used solely for Agriculture, &c.*	Unbroken Horses. 1 Year and above.	Unbroken Horses. Under 1 Year.	Horses Total.	Cattle. Cows and Heifers in Milk or in Calf.	Other Cattle. 2 Years and above.	Other Cattle. Under 2 Years.	Cattle Total.	Sheep. 1 Year Old and above.	Sheep. Under 1 Year.	Sheep Total.	Pigs.
1. Aberdeen	23,459	5,304	1,999	30,762	44,370	47,266	89,291	180,927	135,868	90,812	226,680	10,720
2. Argyll	4,474	1,057	451	5,982	22,525	12,175	25,945	60,645	633,891	292,252	926,143	4,050
3. Ayr	7,087	1,179	449	8,715	50,510	13,964	36,895	101,369	232,253	149,632	381,885	13,324
4. Banff	6,793	1,543	677	9,013	12,973	6,782	25,106	44,861	37,425	26,822	64,247	2,765
5. Berwick	4,380	638	149	5,167	2,861	6,064	7,980	16,905	172,309	153,015	325,324	3,365
6. Bute	971	161	60	1,192	3,694	1,553	4,265	9,512	29,349	15,559	44,908	600
7. Caithness	4,485	684	322	5,491	7,821	2,742	11,958	22,521	79,266	51,930	131,196	1,491
8. Clackmannan	511	92	48	651	1,389	963	1,333	3,685	7,247	5,143	12,390	1,828
9. Dumbarton	1,461	252	76	1,789	8,574	2,215	4,156	14,945	44,805	25,483	70,288	1,499
10. Dumfries	5,703	1,214	464	7,381	20,392	13,597	29,985	63,974	353,162	226,734	579,896	9,116
11. Edinburgh	3,752	415	150	4,317	11,617	4,023	4,225	19,865	110,416	75,343	185,759	7,628
12. Elgin	3,831	742	324	4,897	6,711	4,089	11,871	22,671	41,940	25,372	67,312	2,302
13. Fife	7,847	1,408	489	9,744	11,680	19,856	19,816	51,352	68,838	46,191	115,029	4,746
14. Forfar	8,503	1,123	339	9,965	13,389	22,584	19,799	55,772	99,928	61,878	161,806	6,380
15. Haddington	3,268	212	62	3,542	1,853	5,689	2,348	9,890	75,974	51,073	127,047	1,415
16. Inverness	6,997	1,022	642	8,661	22,049	6,463	22,971	51,483	404,482	191,781	596,263	2,466
17. Kincardine	4,123	648	258	5,029	6,837	7,085	12,575	26,497	26,447	18,153	44,600	2,122
18. Kinross	790	180	79	1,049	1,281	1,589	4,292	7,162	21,804	13,984	35,788	460
19. Kirkcudbright	4,077	1,027	380	5,484	16,233	12,982	21,146	50,361	253,791	153,089	406,880	7,094
20. Lanark	6,484	1,154	404	8,042	39,544	12,491	23,086	75,121	154,829	87,477	242,306	6,180
21. Linlithgow	1,628	310	111	2,049	4,940	3,302	4,124	12,366	16,507	7,275	23,782	1,499
22. Nairn	1,035	277	79	1,391	1,948	746	3,553	6,247	14,715	6,569	21,284	686
23. Orkney	5,250	798	504	6,552	9,858	3,780	15,090	28,728	17,885	17,442	35,327	2,532
24. Shetland	3,071	1,799	1,094	5,964	8,119	4,333	6,598	19,050	70,169	45,142	115,311	2,240
25. Peebles	885	124	41	1,050	2,187	1,571	3,546	7,304	115,643	86,375	202,018	589
26. Perth	10,115	1,566	545	12,226	17,853	20,131	37,916	75,900	479,576	243,680	723,256	6,816
27. Renfrew	2,637	475	134	3,246	17,278	3,189	6,530	26,997	24,159	15,654	39,813	1,053
28. Ross and Cromarty	6,068	1,230	476	7,774	17,615	7,682	19,070	44,367	205,486	105,259	310,745	3,919
29. Roxburgh	3,692	354	104	4,150	4,625	4,908	8,326	17,859	296,595	242,891	539,486	2,664
30. Selkirk	629	56	19	704	1,197	458	1,429	3,084	102,851	80,945	183,796	367
31. Stirling	3,447	775	319	4,541	12,313	9,021	12,935	34,269	77,586	46,592	124,178	2,200
32. Sutherland	2,238	236	84	2,558	5,678	1,807	4,725	12,210	138,752	66,994	205,746	737
33. Wigtown	4,227	1,173	415	5,815	24,067	8,916	18,399	51,382	83,118	47,802	130,920	9,968
Total	153,918	29,228	11,747	194,893	433,981	274,016	521,284	1,229,281	4,627,066	2,774,343	7,401,409	124,821

* Including Mares kept for breeding.

TABLE No. 7.—QUANTITIES AND VALUES OF CORN, MEAT, FOOD PRODUCTS, in the Year 1901, with the

[From Trade and

	Quantities.			Values.		
	1899.	1900.	1901.	1899.	1900.	1901.
ANIMALS, LIVING:—	No.	No.	No.	£	£	£
Cattle	503,504	495,645	494,225	8,572,114	9,012,194	8,817,064
Sheep and lambs .	607,755	382,833	381,481	942,891	610,125	582,969
Swine		..	..	.	..	.
Total value .	..	..	..	9,515,005	9,622,319	9,400,033
CORN:—	Cwt.	Cwt.	Cwt.	£	£	£
Wheat . . .	66,636,078	68,669,490	69,747,830	22,281,219	23,345,929	23,089,087
Wheat meal and flour	22,945,708	21,548,131	22,575,230	10,700,980	10,102,548	10,341,347
Barley . . .	17,189,858	17,054,990	22,091,530	4,950,132	5,152,977	6,218,296
Oats	15,626,730	20,109,560	22,476,070	4,199,724	5,236,409	6,349,449
Peas	2,752,950	2,249,182	2,042,311	898,951	780,138	747,023
Beans . . .	1,877,220	1,717,760	1,871,660	573,891	536,898	631,039
Maize	62,741,350	54,150,570	51,372,800	12,978,025	12,327,859	12,387,342
Maize-meal . .	1,814,766	1,633,505	1,638,026	457,584	456,449	457,345
Other kinds of corn and meal	..	..	..	1,047,236	1,003,183	1,020,099
Total value .	..	..	..	58,087,692	58,942,390	61,241,027
MEAT:—	Cwt.	Cwt.	Cwt.	£	£	£
Beef, salted . .	178,183	192,934	206,514	230,943	256,418	270,409
" fresh . .	3,802,893	4,128,130	4,508,746	7,345,264	8,162,848	8,906,839
Mutton, fresh . .	3,446,022	3,392,850	3,608,229	5,439,317	5,841,566	6,597,780
Bacon	5,804,583	5,641,238	5,772,348	10,399,602	11,773,969	13,590,176
Hams	1,978,626	1,802,670	1,860,670	4,094,500	4,221,809	4,528,388
Pork, salted (not Hams)	284,720	248,728	247,050	305,829	301,349	324,174
Pork, fresh . .	668,972	695,895	791,509	1,403,041	1,495,393	1,715,633
Meat, unenumerated —salted or fresh	464,759	530,688	610,271	883,349	982,169	1,120,447
Meat preserved otherwise than by salting	652,421	805,943	769,364	1,895,716	2,383,938	2,282,262
Rabbits . . .	377,311	473,162	394,036	638,655	730,432	651,698
Total of dead meat	17,658,490	17,911,788	18,768,737	32,636,216	36,149,891	39,987,806
DAIRY PRODUCE:—	Cwt.	Cwt.	Cwt.	£	£	£
Butter . . .	3,389,851	3,378,516	3,702,810	17,213,516	17,450,435	19,297,005
Margarine . . .	953,175	920,412	962,082	2,549,476	2,464,825	2,556,682
Cheese . . .	2,384,069	2,705,878	2,586,885	5,503,004	6,837,883	6,227,277
Total .	6,727,095	7,004,806	7,251,777	25,265,996	26,753,143	28,080,964
POULTRY, &c.:—				£	£	£
Poultry and game, alive or dead	..	..	..	785,294	1,010,869	980,739
	Gt. Hunds.	Gt. Hunds.	Gt. Hunds.			
Eggs	16,174,756	16,882,078	17,072,795	5,044,402	5,406,020	5,495,776
Total value .	..	..	..	5,829,696	6,416,889	6,476,515

and Articles affecting Agriculture, imported into the United Kingdom Corresponding Figures for 1899 and 1900.

Navigation Returns.]

	Quantities.			Values.		
	1899.	**1900.**	**1901.**	**1899.**	**1900.**	**1901.**
Fruit, Vegetables, &c.:	Bushels.	Cwt.	Cwt.	£	£	£
Apples	3,861,172	2,128,541	1,830,208	1,186,143	1,224,657	1,182,798
Cherries	281,236	242,525	212,683	153,642	308,363	213,585
Plums	558,278	423,019	263,700	294,052	392,696	243,705
Pears	571,832	476,901	348,866	266,351	366,860	296,411
Grapes	1,157,647	592,857	679,878	588,467	595,000	694,942
Oranges	8,553,713	5,090,386	5,281,657	2,182,233	2,120,790	2,119,726
Lemons	1,688,503	947,891	1,070,354	453,238	420,857	433,948
*Unenumerated	2,247,785	494,722	535,246	924,823	289,750	302,015
Onions	7,018,299	7,087,105	7,295,418	845,752	852,496	869,188
Potatoes	Cwt. 5,159,011	8,910,962	7,076,882	1,577,726	2,234,569	1,851,862
Vegetables, unenumerated (raw)	..	..	..	1,744,558	766,394	389,828
Hops	180,233	198,494	116,042	809,842	795,479	459,051
Total value	..		.	11,026,827	10,367,911	9,057,059
Other Articles:—						
Lard	Cwt. 2,188,049	Cwt. 1,927,274	Cwt. 1,966,256	£ 3,068,975	£ 3,266,582	£ 4,037,690
Wool, sheep and lambs'	Lb. 663,351,817	Lb. 553,154,732	Lb. 686,931,950	23,714,771	21,836,291	21,503,960
Wood and timber— Hewn	Loads. 2,664,877	Loads. 3,121,148	Loads. 2,772,910	5,319,375	6,462,725	5,451,460
Sawn or split, planed or dressed	6,639,548	6,632,710	6,280,960	16,209,551	18,686,359	16,319,029
Staves	126,216	145,279	140,064	659,312	721,850	730,521
Oilseed cake	Tons. 441,934	Tons. 394,898	Tons. 379,529	2,649,184	2,547,541	2,413,353
Seeds— Clover and grass	Cwt. 299,268	Cwt. 261,957	Cwt. 282,092	549,743	508,913	611,430
Cotton	Tons. 358,012	Tons. 406,478	Tons. 437,150	2,036,550	2,624,450	2,705,597
Flax and linseed	Qrs. 1,798,887	Qrs. 1,666,031	Qrs. 1,684,667	3,383,962	4,162,146	4,263,821
Rape	207,648	134,243	160,654	307,053	246,620	292,010
Bones (whether burnt or not)	Tons. 68,915	Tons. 68,137	Tons. 61,368	313,659	301,803	263,640
Guano	26,911	33,636	22,828	140,075	177,409	104,909
Cotton, raw	Cwt. 14,520,062	Cwt. 15,716,181	Cwt. 16,342,017	27,672,399	40,982,594	41,985,174
Hemp	Tons. 91,973	Tons. 105,227	Tons. 139,806	2,664,647	3,345,761	4,224,252
Flax	99,052	71,586	75,565	2,927,864	2,511,810	3,070,000
Hides untanned— Dry	Cwt. 446,725	Cwt. 747,747	Cwt. 343,436	1,148,189	1,950,389	959,972
Wet	763,548	636,204	757,243	1,689,898	1,467,755	1,783,927
Petroleum	Gallons. 210,147,367	Gallons 254,978,043	Gallons. 254,516,098	4,574,989	5,559,259	5,082,088

* Prior to 1900 "Fruit, Unenumerated (raw)," included Bananas, Currants, Gooseberries, and Strawberries.

TABLE No. 8.—QUANTITY AND VALUE OF CORN, &c., imported into the United Kingdom in the undermentioned Years.

[From Trade and Navigation Returns.]

	Quantities.			Values.		
	1899.	1900.	1901.	1899.	1900.	1901.
Wheat from—	Cwt.	Cwt.	Cwt	£	£	£
Russia	2,518,200	4,478,300	2,541,500	840,789	1,526,300	835,968
Germany	466,030	1,828,300	594,700	152,104	599,502	207,691
Turkey	27,300	131,200	440,700	8,110	42,563	129,081
Roumania	32,100	756,100	512,100	11,050	262,548	158,738
United States—						
On the Atlantic	28,315,948	22,845,870	31,824,400	9,696,331	7,756,345	10,594,752
On the Pacific	6,334,700	10,242,600	8,641,900	2,115,369	3,470,928	2,880,789
Chile	265,300	2,500	.	84,120	868	.
Argentine Republic	11,868,600	18,524,000	8,080,400	3,622,063	6,088,923	2,670,355
British East Indies	8,192,200	6,100	3,341,500	2,651,167	2,181	1,035,440
Australia New Zealand	3,703,030	3,788,200	5,437,700 1,383,100	1,247,744	1,315,477	1,838,532 448,975
Canada	5,256,500	6,337,600	6,696,710	1,801,953	2,206,878	2,216,049
Other countries	156,170	228,720	253,120	50,419	73,421	72,717
Total	66,636,078	68,669,490	60,747,830	22,281,219	23,345,929	23,080,087
Wheat and flour, from—						
Germany	60,707	36,154	34,400	25,861	15,997	15,468
France	641,838	755,848	534,570	275,081	324,122	232,454
Austrian territories	1,029,616	1,167,955	799,588	563,931	629,323	444,722
United States	18,405,796	17,877,308	18,999,882	8,563,884	8,366,256	8,698,249
Canada	2,498,920	1,195,219	1,358,100	1,154,246	570,680	628,611
Other countries	308,831	515,647	848,690	117,977	196,170	321,843
Total	22,945,708	21,548,131	22,575,230	10,700,980	10,102,548	10,341,347
Barley	17,189,358	17,054,990	22,001,530	4,950,132	5,152,977	6,218,296
Oats	15,626,780	20,109,560	22,476,070	4,199,724	5,236,409	6,349,449
Peas	2,752,950	2,249,182	2,042,311	898,951	780,138	747,023
Beans	1,877,220	1,717,760	1,871,660	573,801	536,898	631,089
Indian corn or maize	62,741,350	54,151,570	51,372,800	12,978,025	12,827,859	12,387,842
Indian corn meal	1,814,766	1,633,505	1,638,026	457,534	456,449	457,345
Other kinds of corn and meal	..	..	.	1,047,236	1,003,183	1,020,099
Total of corn, &c.	.	.	.	58,087,692	58,942,390	61,241,027

TABLE No. 9.—RETURN OF THE AVERAGE PRICES OF WOOL in the Years 1899 and 1900.

Years.	Australian.	South African.	English Fleeces.
	Per lb.	Per lb.	Per lb.
	s. d.	s. d.	s. d. s. d.
1899	0 9	0 7¾	0 7 to 0 11
1900	0 10¼	0 8¼	0 6¼ " 1 0

TABLE No. 10.—QUANTITY AND VALUE OF DEAD MEAT imported into the United Kingdom in the undermentioned Years.

[*From Trade and Navigation Returns.*]

	Quantities.			Values.		
	1899.	1900.	1901.	1899.	1900.	1901.
	Cwt.	Cwt.	Cwt.	£	£	£
BACON, from—						
Denmark . . .	1,210,612	1,094,626	1,060,909	2,945,757	3,058,782	3,234,456
Canada . . .	453,773	529,864	398,697	761,861	1,075,445	921,509
United States . .	4,088,546	3,956,527	4,244,329	6,552,180	7,491,943	9,255,851
Other countries . .	51,652	60,221	68,413	139,804	147,799	178,360
Total . .	5,804,583	5,641,238	5,772,848	10,399,602	11,773,969	13,590,176
BEEF (salted), from—						
United States . .	175,056	185,329	192,000	226,842	244,821	246,927
Other countries . .	3,127	7,605	14,514	4,101	11,597	23,482
Total . .	178,183	192,934	206,514	230,943	256,418	270,409
BEEF (fresh), from—						
United States . .	2,756,458	2,867,288	3,180,291	5,711,525	6,059,776	6,761,587
Australia . }	743,643	724,658	243,348	1,124,912	1,168,268	378,701
New Zealand . }			228,126			366,595
Other countries . .	302,792	536,234	856,981	508,827	934,804	1,399,956
Total . .	3,802,893	4,128,130	4,508,746	7,345,264	8,162,848	8,906,839
HAMS, from—						
Canada . . .	150,698	196,182	125,867	301,212	446,942	304,822
United States . .	1,823,965	1,602,453	1,730,536	3,781,007	3,762,714	4,209,816
Other countries . .	3,963	4,035	4,267	12,281	12,153	13,750
Total . .	1,978,626	1,802,670	1,860,670	4,094,500	4,221,809	4,528,388
MEAT (unenumerated, salted or fresh), from—						
Holland . . .	254,001	266,412	284,790	526,271	564,863	616,411
United States . .	123,423	140,473	174,830	214,283	231,342	275,913
Other countries . .	87,335	123,803	150,651	142,795	185,964	228,123
Total . .	464,759	530,688	610,271	883,349	982,169	1,120,447
MEAT, preserved otherwise than by salting—						
Beef	366,349	518,029	464,757	1,063,636	1,457,322	1,289,950
Mutton . . .	87,295	64,462	64,884	156,004	150,973	168,083
Other sorts . .	198,777	223,452	239,723	676,076	775,643	824,229
Total . .	652,421	805,943	769,364	1,895,716	2,383,938	2,282,262
MUTTON (fresh), from—						
Holland . . .	284,886	331,320	316,285	629,040	737,529	711,550
Australia . }	2,001,452	1,933,246	518,639	3,274,976	3,380,241	952,511
New Zealand . }			1,488,217			2,949,441
Argentine Republic .	1,141,208	1,114,795	1,271,654	1,490,076	1,689,078	1,950,599
Other countries . .	18,476	13,489	13,434	45,225	34,718	33,679
Total . .	3,446,022	3,392,850	3,608,229	5,439,817	5,841,566	6,597,780
PORK (salted, not Bacon or Hams), from—						
United States . .	164,042	128,402	137,680	199,850	177,671	207,856
Other countries . .	120,678	120,326	109,370	105,979	123,678	116,318
Total . .	284,720	248,728	247,050	305,829	301,349	324,174
PORK (fresh), from—						
Holland . . .	344,346	389,184	377,061	727,637	823,826	800,729
Belgium . . .	35,342	51,527	40,482	91,996	127,008	98,192
United States . .	276,844	238,179	348,935	553,356	502,618	762,993
Other countries . .	12,440	16,505	25,031	30,052	41,941	53,789
Total .	668,972	695,395	791,509	1,403,041	1,495,393	1,715,633
RABBITS (dead), from—						
Belgium . . .	80,988	58,874	72,363	216,658	161,155	205,325
Australia . }	266,543	387,185	147,751	342,121	494,050	186,994
New Zealand . }			143,575			175,353
Other countries . .	29,785	27,103	30,347	79,876	75,227	84,026
Total . .	377,311	473,162	394,036	638,655	730,432	651,698
Total of dead meat	17,658,490	17,911,738	18,768,737	32,636,216	36,149,891	39,967,806

TABLE No. 11.—QUANTITIES AND VALUES OF BUTTER, MARGARINE, CHEESE, AND EGGS imported into the United Kingdom in each Year from 1899 to 1901 inclusive.

[From Trade and Navigation Returns.]

	Quantities.			Values.		
	1899.	**1900.**	**1901.**	**1899.**	**1900.**	**1901.**
BUTTER from—	Cwt.	Cwt.	Cwt.	£	£	£
*Russia . .	..	209,738	378,452	..	980,770	1,655,352
Sweden . .	245,599	196,041	180,212	1,246,137	1,013,775	938,889
Denmark .	1,430,052	1,486,342	1,597,186	7,553,436	8,029,625	8,950,497
Germany .	36,953	36,042	26,983	186,573	190,820	150,206
Holland . .	284,810	282,805	298,912	1,417,641	1,414,441	1,511,564
France . .	353,942	322,048	311,601	1,908,848	1,785,504	1,704,128
New S. Wales	43,561	81,436	59,597	215,274	394,415	293,917
Queensland .	1,792	1,625	53	9,018	7,630	260
Victoria . .	211,744	264,603	186,141	1,051,358	1,296,438	921,505
New Zealand .	111,639	163,871	167,343	543,367	784,054	819,534
Canada . .	250,083	138,313	215,588	1,113,956	640,760	1,008,002
United States .	159,137	56,046	150,126	704,061	247,724	689,164
Other countries	260,539	139,606	130,616	1,263,847	664,479	653,987
Total .	3,389,851	3,378,516	3,702,810	17,213,516	17,450,435	19,297,005
MARGARINE from—	Cwt.	Cwt.	Cwt.	£	£	£
Norway . .	8,278	8,430	7,787	22,654	23,100	20,553
Holland . .	897,806	862,154	908,919	2,379,044	2,295,174	2,395,633
France . .	29,675	26,587	30,710	103,069	91,189	107,217
Other countries	17,416	23,241	14,666	44,709	55,362	33,279
Total .	953,175	920,412	962,082	2,549,476	2,464,825	2,556,682
CHEESE from—	Cwt.	Cwt.	Cwt.	£	£	£
Holland . .	328,541	327,382	315,930	810,015	799,632	747,035
France . .	34,307	35,110	26,833	103,159	108,065	83,880
Australia	32,294	81,003	149	72,318	218,376	719
New Zealand			79,094			193,149
Canada . .	1,337,198	1,511,872	1,547,779	3,014,211	3,799,223	3,697,780
United States .	590,737	680,583	540,102	1,380,609	1,740,749	1,274,061
Other countries	60,992	69,928	76,998	122,692	171,838	230,658
Total .	2,384,069	2,705,878	2,586,885	5,503,004	6,837,883	6,227,277
EGGS from—	Great Hundreds.	Great Hundreds.	Great Hundreds.	£	£	£
Russia . .	4,318,601	4,024,712	4,492,110	1,183,031	1,109,553	1,207,483
Denmark .	2,266,030	2,438,858	3,019,414	808,543	923,551	1,160,948
Germany .	3,454,986	3,513,988	2,971,813	966,641	1,017,119	895,624
Belgium . .	2,457,558	2,375,983	2,575,642	759,250	733,453	805,241
France . .	2,288,558	2,276,850	1,806,187	867,875	867,532	696,125
Canada . .	646,867	807,702	703,483	233,693	288,945	255,766
Other countries	742,156	1,443,985	1,504,196	225,369	465,867	474,589
Total .	16,174,756	16,882,078	17,072,795	5,044,402	5,406,020	5,495,776

* Not shown separately prior to 1900.

TABLE No. 12.—PRICES OF LIVE STOCK IN 1898, 1899, AND 1900, as returned under the Markets and Fairs (Weighing of Cattle) Act, 1891.

[*From Journal of the Board of Agriculture.*]

NUMBER OF ANIMALS REPORTED AS ENTERING THE 19 SCHEDULED PLACES IN GREAT BRITAIN, TOGETHER WITH THE NUMBERS WEIGHED AND THE NUMBERS PRICED.

ANIMALS.	1900.	1899.*	1898.*
	No.	No.	No.
CATTLE :—			
Entering markets	1,187,603	1,236,091	1,263,991
Weighed	141,611	139,482	138,652
Prices returned	124,648	124,552	124,197
Prices returned with breed and quality distinguished	104,318	103,613	102,299
SHEEP :—			
Entering markets	4,325,613	4,681,602	4,691,619
Weighed	43,581	48,643	49,953
Prices returned with breed and quality distinguished	36,312	42,154	40,460
SWINE :—			
Entering markets	442,216	455,056	363,370
Weighed	2,196	2,205	1,614
Prices returned	2,120	2,070	1,437
Prices returned with quality distinguished	...	...	...

CALCULATED AVERAGE PRICE PER LIVE CWT. IN TWELVE SELECTED PLACES.

(*Obtained by dividing the total price by the total weight of the weighed animals of all descriptions in each of the three qualities or grades.*)

PLACES.	Inferior or third quality.				Good or second quality.				Prime or first quality.			
	1900.		1899.		1900.		1899.		1900.		1899.	
	Per cwt.		Per cwt.		Per cwt.		Per cwt.		Per cwt.		Per cwt.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
ENGLAND :—												
Carlisle	27	6	26	10	31	2	30	8	35	2	34	6
Leeds	28	6	28	0	29	8	28	10	34	4	32	2
Liverpool	26	6	24	6	30	8	30	0	35	4	33	6
London	26	6	26	4	34	10	33	8	39	4	38	0
Newcastle . . .	27	0	28	4	35	8	32	8	38	8	36	2
Shrewsbury . . .	29	2	28	2	33	2	31	2	36	6	34	10
SCOTLAND :—												
Aberdeen	27	4	25	4	34	8	33	2	38	2	36	10
Dundee	27	0	26	4	35	2	32	10	37	10	35	2
Edinburgh . . .	30	8	30	0	36	4	34	6	38	4	36	6
Falkirk	30	8	29	4	34	10	33	2	37	8	35	2
Glasgow	32	8	31	8	34	0	33	0	36	10	35	4
Perth	35	4	30	2	36	4	33	0	38	8	35	6

* Includes the returns from Carlisle and Falkirk.

TABLE No. 13.—NUMBER AND VALUE OF LIVE CATTLE, SHEEP, AND SWINE imported into the United Kingdom in the undermentioned Years. [*From Trade and Navigation Returns.*]

	Number.			Value.		
	1899.	1900.	1901.	1899.	1900.	1901.
CATTLE, from—				£	£	£
Channel Islands	1,732	1,826	1,720	33,101	33,845	31,650
Canada	94,660	104,839	88,559	1,596,097	1,806,238	1,491,472
United States	321,229	350,209	403,946	5,541,781	6,500,744	7,293,942
Argentine Republic	85,365	38,562	..	1,392,599	667,500	..
Other countries	518	209	.	8,536	3,867	.
Total	503,504	495,645	494,225	8,572,114	9,012,194	8,817,064
SHEEP AND LAMBS, from—						
Canada	63,930	35,673	68,010	100,320	56,255	99,506
United States	121,030	142,906	298,039	184,446	224,843	460,349
Argentine Republic	382,080	178,969	.	598,436	289,000	..
Other countries	40,715	25,285	15,432	59,689	40,027	23,114
Total	607,755	382,833	381,481	942,891	610,125	582,969
SWINE (not separately enumerated)	..	..	..	..	..	..
TOTAL VALUE OF ANIMALS LIVING	..	..	..	9,515,005	9,622,319	9,400,033

TABLE No. 14.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS imported into Great Britain from Ireland in each of the Years 1895-1901.

	1895.	1896.	1897.	1898.	1899.	1900.	1901.
HORSES:—							
Stallions	188	191	153	150	122	103	194
Mares	15,370	18,046	17,590	18,200	19,538	16,320	11,467
Geldings	19,002	21,619	20,679	20,454	22,562	19,183	13,946
Total	34,560	39,856	38,422	38,804	42,222	35,606	25,607
CATTLE: Oxen, Bulls, and Cows—							
Fat	302,555	274,472	259,173	278,770	278,220	275,450	261,690
Store	414,859	349,800	419,302	460,903	443,456	427,891	344,954
Other cattle	5,622	3,837	5,043	4,101	6,219	7,442	6,269
Calves	68,571	53,451	62,494	59,588	45,099	34,736	29,725
Total	791,607	681,560	746,012	803,862	772,994	745,519	642,638
SHEEP:—							
Sheep	351,975	397,164	435,709	449,558	452,214	478,081	484,516
Lambs	300,603	340,142	368,806	383,900	423,664	384,182	358,809
Total	652,578	737,306	804,515	833,458	875,878	862,263	843,325
PIGS:—							
Fat	500,700	574,677	653,459	556,723	650,850	673,847	559,232
Store	46,520	35,912	41,848	32,062	37,710	41,355	36,897
Total	547,220	610,589	695,307	588,785	688,560	715,202	596,129

EDINBURGH CORN-MARKET GRAIN TABLES for WHEAT, BARLEY, OATS, and BEANS, showing the Quantity offered for Sale, the Quantity Sold, the Highest, Lowest, and Average Prices; also the Bushel-weights of the Highest and Lowest Prices of each kind of Grain for every Market-day, likewise the Results for every Month, and the final Result for the year 1901.

WHEAT.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1901	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb. lb.	lb. lb.
Jan.							
2	413	262	28 0	24 0	26 7	63	59½
9	780	534	28 0	25 6	27 4	62 63	59¾
16	747	560	27 9	23 0	26 4	63	57½
23	292	210	27 6	25 6	27 2	61¼ 63	60¼
30	657	412	30 0	23 0	27 0	63	59½
	2,889	1,978	28 0	24 3	26 10		
Feb.							
6	338	318	28 0	26 0	27 0	63	61½
13	682	520	30 0	25 6	26 10	64	61½
20	815	606	27 6	24 3	25 11	62 62½	61½
27	452	203	27 0	26 3	26 9	62 63	62
	2,287	1,647	27 7	25 0	26 6		
March							
6	479	396	27 6	25 0	26 1	63	61
13	642	502	27 6	24 6	26 2	63	61
20	425	278	27 0	25 6	26 3	62 63	60 62
27	267	222	27 0	25 6	26 3	63	62
	1,813	1,398	27 2	25 3	26 3		
April							
3	390	220	27 6	25 0	26 6	63	61
10	284	223	27 0	25 9	26 6	63	61½
17	408	338	27 3	24 6	26 4	63¼	60
24	379	275	27 0	25 9	26 9	62 63	62
	1,461	1,056	27 1	25 2	26 6		
May							
1	332	307	28 0	24 9	27 1	63	60½
8	801	684	28 6	25 6	27 4	64	60¼
15	934	839	28 0	25 0	27 6	62 63½	61
22	559	559	29 0	26 6	27 9	64	62
29	823	655	28 6	27 0	28 0	62 63	61½
	3,449	3,044	28 2	26 3	27 7		
June							
5	695	695	29 0	23 6	27 11	63	57½
12	1,228	894	28 6	26 3	27 8	63 64½	61
19	1,758	1,137	28 3	26 0	27 1	64	61½ 62
26	1,177	701	27 6	25 6	27 0	62 63	61
	4,848	3,427	28 2	25 9	27 5		
July							
3	669	512	27 0	22 6	26 7	62 63	58½
10	387	304	26 6	20 0	25 11	62 63	55
17	752	425	26 9	25 0	25 10	63	62
24	793	388	28 3	25 6	26 5	64	63
31	891	726	28 0	23 6	26 1	63	60½
	3,492	2,355	27 1	24 7	26 2		

WHEAT—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.		Lowest Price.		Average Price.		Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1901	Imp. qr.	Imp. qr.	*s.*	*d.*	*s.*	*d*	*s.*	*d.*	lb.	lb.	lb.	lb.
Aug.												
7	1,345	917	27	6	23	0	26	3		64		56½
14	942	602	27	0	26	0	26	10	62	63		62
21	560	457	27	0	25	6	26	6	62	63		63
28	490	261	30	0	25	0	26	7		63		62
	3,337	2,237	27	2	25	8	26	6				
Sept.												
4	541	279	27	0	24	0	26	1		63		62
11	430	305	31	0	22	6	26	1		63		57
18	573	418	29	0	23	6	26	10		61½		59½
25	647	196	30	0	26	6	27	3		63		63
	2,191	1,198	29	0	24	11	26	7				
Oct.												
2	654	338	29	0	26	0	26	8		63		63
9	920	387	29	0	22	0	27	3		63		58
16	1,030	594	30	0	25	0	27	6		63		60¼
23	996	486	30	0	25	0	27	1	63	63½		61
30	890	399	30	0	21	0	27	8	62	63		53¼
	4,490	2,204	29	9	25	3	27	3				
Nov.												
6	634	356	40	0	22	6	28	6		63		59½
13	474	221	30	0	25	6	28	8	62	63		62
20	440	384	29	3	27	0	28	6		63		63
27	207	207	30	0	25	6	28	8		63		58½
	1,755	1,168	30	5	25	6	28	7				
Dec.												
4	214	205	31	0	29	6	30	0		63		60¾
11	331	312	32	0	30	0	31	1	63	63½	62	63
18	318	301	33	3	29	0	30	11		61		61
24	188	178	32	0	29	0	31	6		63		63
31	249	249	32	0	30	6	31	3		64	61	63
	1,300	1,245	32	1	29	11	30	11				
Result for year	33,312	22,957	28	0	25	8	27	2				

BARLEY.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.		Lowest Price.		Average Price.		Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1901												
Jan.												
2	1,485	811	26	3	21	6	23	9		56		58¼
9	2,262	1,366	26	6	20	0	24	0		56		55
16	2,212	1,267	28	0	21	0	23	9		56½	58	54
23	1,833	973	27	0	20	6	24	5		56		58½
30	1,577	959	27	0	22	6	24	3		56	52¼	58¾
	9,369	5,376	26	8	21	4	24	0				
Feb.												
6	2,090	1,487	25	6	21	0	23	11	55	56	58	58¾
13	1,691	971	26	6	21	0	24	0		56		51
20	1,858	938	30	0	20	0	24	1		56		50
27	1,391	894	28	0	22	6	23	9		56½	58	55
	7,025	4,290	26	5	22	0	23	11				

BARLEY—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1901 March	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
6	1,396	1,009	28 0	21 0	24 8		56		51½
13	1,312	823	32 0	23 0	24 7		56½	53½	56
20	1,147	609	29 0	23 0	24 9		57½		54
27	818	419	28 0	22 0	25 1		55		52
	4,673	2,860	28 6	22 7	24 9				
April									
3	886	732	27 0	24 0	25 5		56		55
10	425	246	26 0	24 9	25 7	55	56		54½
17	524	336	28 0	20 6	25 6		56		53¾
24	323	234	26 0	23 0	25 3		55		53¼
	2,158	1,548	26 1	23 2	25 5				
May									
1	257	128	26 6	23 3	25 3		56		53¼
8	225	110	26 9	24 0	25 4		55		55
15	331	300	27 0	24 6	26 2	55	56		55
22	158	136	26 6	26 0	26 2	55	56		55
29	129	..	..	..	..				..
	1,095	674	26 9	25 6	25 10				
June									
5	58	58	25 6	24 6	25 1		56		55
12	75	75	25 6	23 0	24 2		56		53
19	..	..	..	..	..		.		..
26	20	..	..	..	..		..		..
	153	133	25 6	23 4	24 7				
July									
3	70	70	27 0	25 0	26 5		56		54¼
10	100	80	24 3	24 0	24 2		53½		53
17	30	..	..	..	..		..		.
24	5	5	25 6	..	25 6		56		..
31	..	..	..	..	..		..		..
	205	155	25 7	24 6	25 3				
Aug.									
7	29	..	..	..	..		..		..
14	57	12	25 0	..	25 0		55		.
21	1,132	822	30 6	23 6	28 4	56½	57½		55
28	3,285	2,555	30 0	24 6	26 11		61½	55	56
	4,503	3,389	29 11	24 5	27 3				
Sept.									
4	2,499	1,953	30 6	21 6	27 1		56		51½
11	3,083	1,781	30 0	23 0	27 3		56		55
18	3,506	1,579	29 6	22 0	25 5		56		54½
25	2,771	1,462	29 0	22 0	25 9		56	52½	53½
	11,859	6,725	29 8	22 4	26 5				
Oct.									
2	2,296	1,423	28 0	22 0	25 2		56	55	55½
9	1,614	1,054	29 0	21 6	26 4		56		54
16	1,488	742	28 6	23 0	26 0	56	56½		54
23	1,719	910	28 3	23 0	25 10		58		55
30	1,538	1,015	30 0	22 6	26 0		56		53½
	8,655	5,144	28 8	22 5	25 11				

BARLEY—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1901	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
Nov.									
6	2,418	1,474	29 6	24 0	26 11		56		56
13	1,215	588	29 6	24 0	27 4		56	52½	56
20	2,917	1,723	29 6	21 6	27 7		56		53½
27	1,898	1,195	30 6	24 6	28 3		55½		55
	8,443	4,975	29 8	23 8	27 6				
Dec.									
4	2,028	1,337	31 0	23 0	28 0		55½		56
11	1,847	1,117	31 0	25 0	28 1	55½	56		56
18	2,130	1,006	30 6	23 6	28 0		56		56
24	1,488	582	30 0	23 9	28 3		55		54
31	2,155	1,041	31 6	25 0	27 6		56		56
	9,648	5,083	30 9	24 8	27 11				
Result for year	67,786	40,352	28 2	23 0	26 0				

OATS.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Highest Price (lb.)		Lowest Price (lb.)	
1901									
Jan.									
2	1,392	595	22 3	13 0	18 4		44½		40
9	1,767	1,296	21 3	14 3	19 2		44½		39¼
16	2,061	1,447	21 3	14 9	19 2		43½		40
23	1,565	736	23 0	16 3	19 0		43		40
30	1,757	757	22 0	16 0	19 1		44½		40
	8,542	4,831	21 9	15 0	19 0				
Feb.									
6	1,629	696	22 3	17 9	20 0		43½	40	42¾
13	2,021	1,150	23 6	17 0	20 2		44½		40
20	2,381	770	35 0	16 6	20 1		43½		41
27	2,463	978	32 6	15 6	20 5		42		39¾
	8,494	3,594	27 4	16 11	20 2				
March									
6	3,097	1,085	25 0	17 0	20 9	43¼	44		40¼
13	3,541	1,825	27 0	16 0	21 1		43½		41
20	2,866	1,280	26 0	16 0	21 1		44		41
27	2,476	1,193	24 0	18 0	21 1		43¼		40
	11,980	4,883	25 2	17 2	21 0				
April									
3	2,040	897	25 0	16 0	21 5	43½	44½		39
10	1,481	910	24 6	17 6	21 10		44		41
17	1,778	887	24 0	19 6	22 1		44		41
24	1,179	588	24 9	19 3	22 0		43½		42
	6,478	3,282	24 6	18 9	21 10				
May									
1	1,294	844	25 6	19 6	23 2		44		40
8	1,398	791	25 6	20 3	23 7		44		41
15	1,771	767	26 0	20 6	23 4	44	44½	40	41
22	2,021	701	25 0	22 6	24 0		43½		42
29	1,513	288	25 6	21 0	23 1		44		42
	7,997	3,391	25 6	20 7	23 6				

Oats—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.		Table of Bushel-weights for Lowest Price.	
1901 June	Imp. qr.	Imp. qr	s. d.	s. d.	s. d.	lb.	lb.	lb.	lb.
5	1,788	461	25 0	21 0	23 5		44½		41½
12	2,054	425	24 0	21 0	23 1	43	44		41
19	2,515	989	24 3	21 0	22 11		45½	41	43
26	2,068	550	24 0	19 6	22 4		44		42
	8,370	2,375	24 2	20 10	22 11				
July 3	1,191	588	24 3	19 9	22 10		44		41
10	1,152	471	24 9	20 6	22 10		44		43
17	1,325	801	25 0	19 0	21 11		44		42
24	1,491	590	25 0	18 0	22 1		44		40
31	1,386	539	24 3	19 3	22 7		44½		42½
	6,545	2,989	24 7	19 5	22 5				
Aug. 7	1,067	328	24 6	20 6	22 2		44	42	42½
14	1,393	631	24 0	18 6	22 3	42	42¾		42½
21	2,818	1,489	23 3	18 0	21 5		43½		41
28	3,135	2,035	22 0	18 0	20 5	44	45¾		42
	8,418	4,483	22 8	19 3	21 2				
Sept. 4	2,345	1,432	23 0	16 6	19 11		44½		38
11	1,452	1,099	23 6	18 0	20 6		43	41	42
18	2,254	1,575	22 0	17 9	20 4		45½		42
25	1,856	879	21 6	16 6	19 10		44½		40
	7,907	4,985	22 3	17 3	20 2				
Oct. 2	1,920	909	21 6	17 0	19 9	44	44½		41
9	1,288	751	21 9	17 6	20 3		45½		41
16	1,956	1,096	21 9	18 0	20 4	44½	46		42
23	1,947	1,198	22 0	18 3	19 10		43	41½	42¾
30	2,195	1,490	21 9	17 6	20 4		45½		42
	9,306	5,534	21 8	17 10	20 1				
Nov. 6	1,994	1,684	22 0	18 3	20 6	44½	45		42
13	1,581	1,409	22 6	19 0	21 3	45	45½		42
20	1,760	1,420	23 6	19 3	21 11		45½		42
27	1,953	1,544	24 0	20 6	22 2		44½		42
	7,288	6,007	22 9	19 7	21 5				
Dec. 4	2,780	1,954	24 6	21 0	22 7		47		42
11	2,678	1,901	24 0	21 0	22 8	45	45½		42
18	2,745	2,121	24 6	20 9	22 11		45		40
24	1,796	1,097	24 3	21 0	23 1		44½	41	42
31	2,966	1,703	24 6	21 0	22 9		45½	40	42
	12,915	8,776	24 3	20 11	22 9				
Result for year	104,285	55,080	23 5	18 10	21 4				

BEANS.

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1901 Jan.	Imp. qr.	Imp. qr.	s. d.	s. d.	s. d.	lb. lb.	lb. lb.
2	10	10	30 3	..	30 3	63	..
9	..	..	..	..	..		
16	8	8	29 0		29 0	62	..
23	12	..	..	.	..	..	
30	20	20	30 0	..	30 0	62	.
	50	38	29 10	.	29 10		
Feb.							
6	60	60	31 6	30 0	30 3	62	63
13	121	34	30 0	29 3	29 11	63	61½
20	235	157	35 0	29 6	31 8	65½	63
27	162	122	35 0	30 6	31 10	65½	64
	578	373	32 3	30 2	31 4		
March							
6	50	40	25 6	34 0	34 6	65½	64 65½
13	31	6	32 0	.	32 0	63	..
20	38	..	.	..	..	..	..
27	..	..	..	..	..	..	..
	119	46	34 5	34 0	34 2		
April							
3	..	..	..	..	..	.	..
10	..	..	..	..	..	..	.
17	7	7	30 0	..	30 0	63	.
24	..	..	..	..	..	..	
	7	7	30 0	..	30 0		
May							
1	..	..	..	..	..	..	..
8	..	..	..	..	..	..	.
15	..	..	..	..	..	..	.
22	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..
	..	..	..	..	..		
June							
5	..	..	..	..	..	..	..
12	..	..	..	..	.	..	..
19	4	4	32 6	..	32 6	62	..
26	..	..	..	..	..	..	..
	4	4	32 6	..	32 6		
July							
3	..	..	..	..	..	.	..
10	.	..	..	..	..	..	..
17	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..
31	..	..	..	..	.	..	..
	.	..	..	..	..		
Aug.							
7	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..
	..	..	..	..	..		

Beans—*continued.*

Date.	Quantity offered for Sale.	Quantity Sold.	Highest Price.	Lowest Price.	Average Price.	Table of Bushel-weights for Highest Price.	Table of Bushel-weights for Lowest Price.
1901 Sept.	Imp. qr.	Imp. qr.	*s. d.*	*s. d.*	*s. d.*	lb. lb.	lb. lb.
4	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..
18	..	..	..	..	.	.	..
25	..		.	..	.	..	..
	..	..	.	..	..		
Oct.							
2	17	5	34 6	..	34 6	63	..
9	30	..	..	..	..	..	..
16	.	.	..	..	.	..	.
23	..	.	..	..	..	.	..
30	..		..		.		..
	47	5	34 6	.	34 6		
Nov.							
6	20	20	34 6	..	34 6	65½	..
13	..	.	.	..	..	.	..
20	..	..	..	..		.	..
27	..	.	..	..	..		..
	20	20	34 6	.	34 6		
Dec.							
4	..	.	..	.	..	..	.
11	7	7	34 0	..	34 0	63	..
18	26	18	35 0	..	35 0	63¼	.
24	..	.	.	..	..	..	
31	54	24	35 0	.	35 0	66¼	..
	87	49	34 10	..	34 10		
Result for year	912	542	32 10	20 10	31 11		

PRICES OF SHEEP SINCE 1818.

Table No. 1.—CHEVIOT SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
1818	28	0	to	30	0	not quoted.					8	0	to	10	0
1819	25	0	"	27	0	15	0	to	17	0	10	6	"	12	0
1820	20	0	"	25	0	16	0	"	17	0	10	0	"	11	0
1821	18	0	"	20	0	14	0	"	16	0	7	6	"	8	0
1822	12	6	"	13	0	8	0	"	8	6	4	6	"	0	0
1823	13	6	"	18	0	7	0	"	10	6	5	6	"	6	0
1824	14	0	"	19	0	7	0	"	9	0	4	6	"	6	0
1825	29	0	"	32	0	15	0	"	19	0	9	0	"	10	6
1826	17	6	"	21	6	13	0	"	15	0	7	0	"	7	6
1827	15	0	"	24	0	not quoted.					7	0	"	8	0
1828	18	0	"	27	6	12	0	to	15	0	7	0	"	8	3
1829	18	0	"	24	0	12	6	"	14	0	7	0	"	8	6
1830	15	0	"	21	0	8	0	"	11	0	6	0	"	6	9
1831	18	0	"	25	0	9	0	"	13	0	7	0	"	8	0
1832	19	0	"	24	0	11	0	"	16	0	7	0	"	9	0
1833	22	0	"	31	0	13	6	"	20	0	8	0	"	11	3
1834	22	0	"	31	0	18	6	"	21	0	9	0	"	11	6
1835	22	0	"	27	6	18	0	"	20	6	8	0	"	11	0
1836	24	0	"	31	6	16	0	"	19	0	10	0	"	14	0
1837	19	0	"	28	0	14	0	"	19	0	10	0	"	13	0
1838	23	0	"	30	6	17	0	"	22	0	12	0	"	14	0
1839	23	0	"	31	0	14	0	"	19	0	0	0	"	13	0
1840	24	0	"	33	0	15	0	"	23	0	7	0	"	11	6
1841	23	0	"	30	0	14	0	"	22	0	8	0	"	12	0
1842	22	6	"	28	0	13	0	"	17	0	7	6	"	10	0
1843	19	0	"	25	0	8	0	"	12	0	5	0	"	8	0
1844	21	0	"	29	0	10	0	"	16	0	8	0	"	10	6
1845	23	0	"	33	0	13	0	"	20	0	8	0	"	13	0
1846	24	0	"	33	6	14	6	"	21	6	10	0	"	14	6
1847	24	0	"	35	0	18	0	"	24	0	11	6	"	15	0
1848	23	0	"	34	6	13	0	"	28	0	11	6	"	15	0
1849	21	0	"	30	2	12	0	"	21	0	0	0	"	14	0
1850	20	6	"	29	6	12	0	"	20	0	8	0	"	13	0
1851	21	6	"	31	0	13	0	"	21	0	8	9	"	14	0
1852	21	0	"	32	0	15	0	"	23	0	8	0	"	14	0
1853	26	6	"	38	0	17	0	"	28	6	9	0	"	17	0
1854	25	0	"	36	0	17	0	"	26	0	9	0	"	16	6
1855	23	6	"	36	0	16	0	"	25	0	10	0	"	17	0
1856	22	0	"	35	6	15	6	"	24	0	10	0	"	15	0
1857	24	0	"	36	0	14	6	"	26	0	10	6	"	14	6
1858	24	0	"	34	6	14	0	"	24	6	10	6	"	14	0
1859	25	0	"	34	6	16	0	"	25	0	10	3	"	14	9
1860	26	0	"	38	0	17	6	"	27	6	12	6	"	17	6
1861	25	0	"	38	6	16	0	"	28	0	9	0	"	16	0
1862	27	0	"	37	6	17	6	"	28	0	10	0	"	16	0
1863	25	0	"	38	6	19	0	"	28	6	10	6	"	16	0
1864	31	0	"	41	0	21	0	"	31	6	14	0	"	18	0
1865	32	6	"	44	0	22	6	"	33	6	14	6	"	20	0
1866	37	0	"	50	0	29	0	"	42	6	15	0	"	26	0
1867	26	0	"	58	0	18	0	"	25	6	12	0	"	16	0
1868	30	0	"	32	0	15	6	"	21	0	7	6	"	13	0
1869	28	0	"	38	0	15	0	"	22	6	7	6	"	14	0
1870	35	6	"	43	0	18	0	"	28	0	10	0	"	17	0
1871	36	6	"	49	0	22	0	"	38	6	14	0	"	20	0
1872	45	0	"	56	0	32	0	"	42	0	16	0	"	22	0
1873	42	0	"	51	0	25	0	"	42	0	15	6	"	22	0
1874	33	6	"	44	6	21	0	"	36	0	12	0	"	17	0
1875	33	0	"	48	6	21	0	"	34	0	13	6	"	23	6
1876	40	0	"	52	6	23	0	"	30	0	13	6	"	25	0
1877	41	0	"	51	0	25	0	"	37	0	15	0	"	24	0
1878	35	6	"	48	0	23	6	"	35	0	14	0	"	22	0
1879	34	0	"	44	0	21	0	"	34	0	14	0	"	20	0
1880	30	0	"	43	6	20	0	"	30	0	12	6	"	20	0
1881	32	0	"	45	6	29	0	"	34	0	14	0	"	20	0
1882	40	0	"	51	0	30	0	"	40	0	14	0	"	20	6
1883	44	0	"	55	6	34	6	"	46	6	15	6	"	23	0
1884	36	0	"	47	6	29	6	"	41	6	12	6	"	20	0

TABLE No. 1.—CHEVIOT SHEEP—*Continued.*

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s*	*d.*	*s.*	*d.*		*s.*	*d.*
1885	30	0	to	38	0	24	0	to	31	0	12	0	to	18	0
1886	32	0	″	40	0	21	0	″	29	0	12	6	″	19	0
1887	29	0	″	36	0	18	0	″	26	0	11	0	″	16	6
1888	30	0	″	38	0	19	0	″	27	0	12	0	″	17	6
1889	36	0	″	44	0	24	0	″	32	0	14	0	″	22	0
1890	31	0	″	40	0	22	0	″	30	0	12	6	″	20	0
1891	27	0	″	38	0	16	0	″	25	0	9	0	″	16	0
1892	22	0	″	30	6	18	0	″	22	0	5	0	″	11	0
1893	26	0	″	35	6	18	0	″	28	6	8	6	″	15	0
1894	26	0	″	37	0	20	0	″	31	0	10	6	″	18	6
1895	28	0	″	39	0	22	0	″	34	0	11	6	″	19	6
1896	24	6	″	34	0	19	0	″	30	6	9	0	″	16	6
1897	27	0	″	36	0	21	0	″	31	6	11	0	″	17	6
1898	27	0	″	37	0	22	0	″	32	6	12	0	″	18	6
1899	24	0	″	33	0	20	0	″	30	6	10	6	″	16	0
1900	26	0	″	36	0	22	0	″	32	6	12	0	″	17	0
1901	25	0	″	32	6	20	0	″	29	6	11	0	″	16	0

TABLE No. 2.—BLACKFACED SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s*	*d.*	*s.*	*d.*		*s.*	*d.*
1819	22	0	to	24	0	12	0	to	15	0	8	0	to	9	0
1820	20	0	″	23	3	15	6	″	17	0	7	0	″	8	6
1821	18	0	″	20	0	12	0	″	13	0	6	0	″	7	0
1822	11	6	″	13	6	5	6	″	6	0	4	6	″	0	0
1823	12	0	″	16	0	5	0	″	6	6	4	0	″	5	3
1824	9	6	″	13	6	6	0	″	7	0	4	0	″	5	0
1825	22	0	″	26	0	11	0	″	13	6	6	0	″	9	0
1826	15	0	″	17	0	8	0	″	9	0	4	6	″	6	0
1827	14	0	″	18	6	7	0	″	10	0	6	0	″	7	6
1828	15	0	″	20	0	8	0	″	11	0	5	0	″	7	6
1829	14	0	″	18	0	9	0	″	10	0	6	0	″	7	0
1830	9	6	″	13	0	4	0	″	6	0	4	6	″	6	0
1831	13	0	″	17	0	5	0	″	7	6	5	0	″	6	6
1832	14	0	″	18	0	7	0	″	11	6	6	0	″	7	8
1833	16	0	″	24	0	7	6	″	12	0	6	6	″	9	0
1834	16	0	″	22	0	10	0	″	13	0	6	0	″	8	6
1835	15	0	″	18	9	10	0	″	13	0	7	0	″	8	0
1836	15	0	″	21	0	9	0	″	12	0	8	6	″	11	0
1837	13	0	″	16	0	8	0	″	12	0	8	0	″	9	6
1838	15	0	″	20	6	10	0	″	13	0	not quoted				
1839	15	0	″	22	0	10	0	″	12	0	7	0	to	8	3
1840	15	0	″	22	6	11	0	″	12	0	7	0	″	9	3
1841	16	0	″	20	0	9	0	″	11	0	6	0	″	8	0
1842	14	0	″	19	0	7	6	″	8	0	5	6	″	7	0
1843	not quoted.					4	9	″	6	6	not quoted.				
1844	15	0	to	21	0	6	6	″	10	0	5	0	to	8	0
1845	14	0	″	23	0	8	0	″	12	0	6	0	″	8	0
1846	13	0	″	24	0	10	0	″	13	0	8	0	″	9	0
1847	20	6	″	25	0	10	0	″	14	0	8	6	″	9	6
1848	20	0	″	24	0	11	3	″	12	0	8	6	″	10	0
1849	not quoted.					not quoted.					7	0	″	7	6
1850	..					..					7	0	″	0	0
1851	17	6	to	23	0	9	0	to	12	0	6	6	″	8	0
1852	18	6	″	22	0	9	6	″	12	0	4	6	″	7	9
1853	23	0	″	27	0	14	6	″	16	6	8	0	″	11	6
1854	20	0	″	26	0	11	0	″	16	6	8	0	″	10	6
1855	23	6	″	26	6	14	0	″	16	0	10	0	″	11	0
1856	17	0	″	24	0	10	0	″	20	0	7	6	″	10	0
1857	20	0	″	29	0	10	6	″	15	0	9	3	″	11	0
1858	20	0	″	27	6	9	9	″	18	9	8	3	″	10	6
1859	20	0	″	25	0	10	0	″	14	0	8	9	″	11	0
1860	21	0	″	27	3	11	0	″	16	0	10	0	″	13	6

Table No. 2.—BLACKFACED SHEEP—*Continued.*

Year.	Wethers.					Ewès.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1861	21	0	to	29	0	12	0	to	22	0	6	3	to	14	0
1862	16	9	〃	27	0	12	0	〃	18	8	6	0	〃	12	0
1863	20	0	〃	30	6	13	0	〃	16	0	8	0	〃	11	6
1864	25	0	〃	30	0	15	0	〃	19	0	10	0	〃	18	6
1865	15	6	〃	32	6	15	0	〃	25	0	10	0	〃	17	0
1866	31	6	〃	40	0	20	0	〃	36	0	13	6	〃	22	6
1867	20	0	〃	30	6	14	0	〃	22	0	7	6	〃	18	6
1868	20	0	〃	26	0	10	6	〃	13	6	7	0	〃	13	0
1869	22	0	〃	28	0	11	0	〃	14	0	6	9	〃	9	0
1870	27	0	〃	32	6	13	0	〃	22	0	8	0	〃	14	6
1871	23	0	〃	37	0	13	0	〃	23	0	11	0	〃	16	3
1872	31	6	〃	45	0	18	0	〃	32	0	12	6	〃	18	0
1873	28	0	〃	39	0	16	6	〃	27	0	7	0	〃	16	0
1874	25	0	〃	35	0	13	0	〃	20	0	7	0	〃	14	0
1875	26	6	〃	37	6	15	0	〃	21	3	9	6	〃	17	6
1876	30	0	〃	40	0	19	0	〃	24	0	13	0	〃	20	6
1877	35	0	〃	38	9	18	0	〃	25	0	13	6	〃	23	0
1878	30	0	〃	36	0	17	0	〃	23	0	12	0	〃	22	0
1879	25	0	〃	35	9	16	0	〃	24	0	10	6	〃	20	0
1880	25	0	〃	38	0	16	6	〃	22	6	10	0	〃	17	0
1881	30	0	〃	39	0	15	0	〃	23	0	10	0	〃	15	0
1882	33	0	〃	46	0	20	0	〃	28	0	12	6	〃	18	6
1883	36	0	〃	50	6	24	6	〃	33	0	14	0	〃	21	6
1884	29	0	〃	43	6	19	6	〃	28	0	12	0	〃	19	6
1885	24	0	〃	34	0	13	0	〃	22	6	10	0	〃	15	0
1886	25	0	〃	34	0	12	0	〃	22	0	10	6	〃	16	0
1887	22	0	〃	30	0	11	0	〃	19	0	8	0	〃	13	0
1888	22	0	〃	32	0	13	0	〃	24	0	10	0	〃	15	0
1889	26	0	〃	40	0	18	0	〃	29	0	13	0	〃	22	0
1890	24	0	〃	37	0	14	0	〃	27	0	10	6	〃	19	0
1891	21	0	〃	37	0	10	0	〃	24	0	7	6	〃	15	0
1892	16	0	〃	28	6	6	0	〃	17	0	3	0	〃	10	0
1893	21	0	〃	37	0	12	0	〃	24	0	7	0	〃	14	6
1894	20	0	〃	37	6	14	6	〃	26	6	8	6	〃	16	0
1895	23	0	〃	41	0	16	0	〃	28	6	9	0	〃	17	0
1896	19	0	〃	35	4	13	0	〃	24	0	6	0	〃	13	6
1897	21	0	〃	36	6	15	0	〃	25	6	7	0	〃	14	6
1898	22	0	〃	37	0	16	0	〃	26	6	8	0	〃	15	0
1899	20	0	〃	33	6	13	0	〃	24	0	5	6	〃	13	0
1900	23	0	〃	36	0	16	0	〃	26	6	8	0	〃	15	6
1901	20	0	〃	35	0	14	0	〃	25	6	6	6	〃	14	6

Table No. 3.—PRICE OF WOOL, per stone of 24 lb., since 1818.

Year.	Laid Cheviot.					White Cheviot.	Laid Highland					White Highland.
	s.	*d.*		*s.*	*d.*	*s. d.* *s. d.*	*s.*	*d.*		*s.*	*d.*	*s. d.* *s. d.*
1818	40	0	to	42	2	..	20	0	to	22	6	..
1819	21	0	〃	22	0	..	10	0	〃	10	8	..
1820	20	0	〃	22	0	..	9	0	〃	10	0	..
1821	18	0	〃	20	0	..	9	0	〃	10	0	..
1822	12	6	〃	14	6	..	5	0	〃	6	6	..
1823	9	0	〃	10	6	..	5	0	〃	5	9	..
1824	13	6	〃	15	0	..	6	0	〃	6	8	..
1825	10	6	〃	22	0	..	10	0	〃	10	6	..
1826	11	0	〃	14	0	..	5	0	〃	5	6	..
1827	11	0	〃	14	0	..	5	6	〃	6	9	..
1828	8	0	〃	11	0	..	5	6	〃	6	0	..
1829	8	6	〃	11	0	..	4	8	〃	0	0	..
1830	9	6	〃	11	0	..	4	6	〃	5	0	..
1831	17	0	〃	20	0	..	7	6	〃	8	6	..
1832	14	0	〃	16	0	..	7	0	〃	7	6	..
1833	18	0	〃	20	7	..	10	0	〃	11	0	..
1834	21	0	〃	24	6	..	5	6	〃	7	0	..
1835	19	0	〃	20	6	..	9	6	〃	10	8	..

TABLE NO. 3.—PRICE OF WOOL—*Continued.*

Year.	Laid Cheviot.	White Cheviot.	Laid Highland.	White Highland.
	s. *d.* *s.* *d.*	*s.* *d.* *s.* *d.*	*s.* *d.* *s.* *d.*	*s.* *d.* *s.* *d.*
1836	21 0 to 25 0	..	10 0 to 14 0	..
1837	12 0 " 14 0	..	7 0 " 7 8	..
1838	19 0 " 22 6	..	6 0 " 10 0	..
1839	18 0 " 20 0	..	8 0 " 12 0	..
1840	15 0 " 0 0	..	7 0 " 0 0	..
1841	15 0 " 16 9	..	6 0 " 7 5	..
1842	12 6 " 14 0	..	not quoted.	..
1843	9 0 " 11 6	..	5 0 to 6 0	..
1844	15 0 " 18 0	..	not quoted.	..
1845	14 6 " 17 6	..	7 6 to 8 6	
1846	12 0 " 14 6	..	8 0 " 8 6	..
1847	12 6 " 14 0	..	not quoted.	..
1848	9 6 " 11 0	..	4 9 to 0 0	..
1849	12 0 " 16 6	..	6 0 " 6 3	..
1850	15 0 " 17 6	..	8 0 " 8 6	..
1851	12 0 " 16 0	..	8 0 " 9 3	..
1852	13 0 " 15 0	..	8 0 " 9 0	..
1853	19 0 " 22 0	..	11 0 " 12 6	..
1854	12 0 " 15 0	..	7 6 " 8 6	..
1855	14 6 " 19 0	..	8 6 " 9 0	..
1856	19 0 " 21 6	..	11 0 " 0 0	..
1857	19 0 " 24 0	..	13 0 " 14 3	..
1858	15 0 " 17 0	..	8 9 " 10 0	..
1859	18 6 " 24 0	..	10 9 " 11 6	..
1860	22 0 " 32 0	37 0 to 38 0	10 0 " 11 3	..
1861	19 6 " 27 0	from 30s. upwards.	not quoted.	..
1862	18 6 " 26 0	30 0 to 37 0	11 6 to 16 0	..
1863	25 6 " 31 0	38 0 " 42 0	15 3 " 17 6	..
1864	31 0 " 39 0	47 0 " 54 0	17 6 " 20 0	..
1865	23 0 " 30 0	44 0 " 45 0	15 0 " 17 0	..
1866	24 0 " 30 0	30 0 " 38 0	14 0 " 16 0	..
1867	16 0 " 21 6	not quoted.	not quoted.	..
1868	19 0 " 26 0	28 0 to 32 0	8 6 to 9 0	..
1869	18 0 " 26 6	not quoted.	8 6 " 10 0	..
1870	15 0 " 23 6	25 0 to 26 0	9 6 " 0 0	..
1871	20 0 " 26 6	30 0 " 34 6	12 0 " 15 0	..
1872	26 0 " 37 6	40 0 " 48 0	18 0 " 21 0	..
1873	17 0 " 18 0	34 0 " 40 0	9 0 " 12 0	..
1874	18 6 " 26 6	30 0 " 34 0	9 6 " 13 0	..
1875	25 0 " 32 0	34 6 " 36 0	12 6 " 16 0	..
1876	20 0 " 24 0	30 0 " 34 6	9 6 " 12 0	..
1877	20 9 " 26 0	28 0 " 30 0	10 0 " 12 0	..
1878	18 9 " 25 0	27 0 " 32 0	8 6 " 11 6	..
1879	15 0 " 17 0	prices very low.	7 0 " 0 0	
1880	20 0 " 24 0	30 0 to 32 0	10 6 " 11 6	14 0 to 15 0
1881	17 0 " 21 0	27 0 " 30 0	5 0 " 9 6	12 0 " 13 0
1882	14 0 " 18 0	27 6 " 28 0	7 6 " 9 0	13 0 " 14 0
1883	13 0 " 18 0	26 0 " 28 0	6 6 " 8 6	11 6 " 12 6
1884	13 0 " 18 0	26 0 " 28 0	6 6 " 8 6	11 6 " 12 6
1885	12 0 " 17 0	22 6 " 26 0	6 0 " 8 0	11 6 " 12 0
1886	18 0 " 18 0	23 0 " 27 6	6 6 " 8 6	11 6 " 12 0
1887	14 0 " 22 0	23 0 " 28 0	7 0 " 9 0	11 6 " 13 0
1888	18 0 " 20 0	23 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1889	13 0 " 18 0	24 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1890	13 0 " 18 0	24 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1891	12 6 " 18 0	22 0 " 28 0	7 0 " 9 0	11 0 " 12 6
1892	12 0 " 18 0	20 0 " 28 0	7 0 " 8 6	10 6 " 12 0
1893	12 0 " 17 0	20 0 " 27 0	7 0 " 8 0	10 0 " 12 0
1894	12 0 " 16 0	20 0 " 26 0	7 0 " 8 0	10 0 " 12 0
1895	12 0 " 16 0	20 0 " 25 0	7 0 " 8 0	10 0 " 11 6
1896	11 0 " 15 0	19 0 " 24 0	7 0 " 8 0	10 0 " 11 6
1897	11 0 " 14 0	18 0 " 23 0	7 0 " 8 0	10 6 " 12 0
1898	10 0 " 13 0	16 0 " 20 0	7 0 " 8 0	10 0 " 11 6
1899	10 0 " 13 0	13 0 " 18 6	7 0 " 8 0	8 6 " 9 6
1900	9 9 " 12 0	13 0 " 18 6	6 9 " 7 9	8 0 " 9 6
1901	9 0 " 10 0	11 0 " 16 6	5 9 " 6 6	8 0 " 9 0

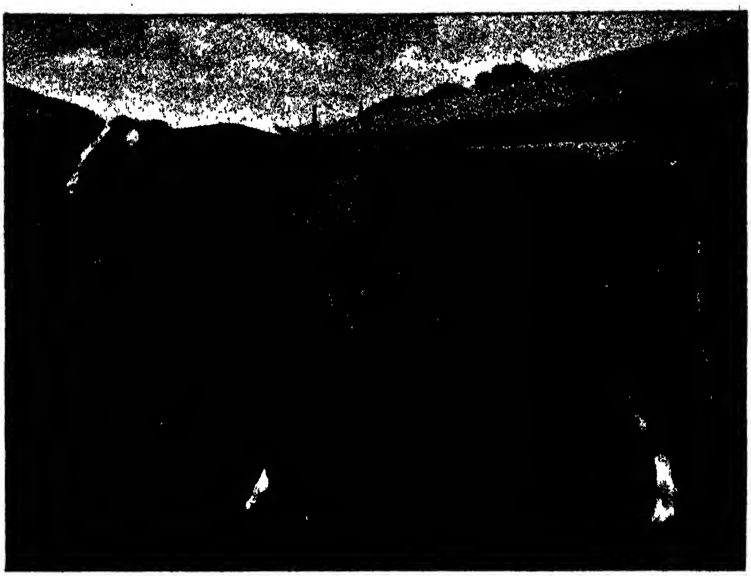

Fig. 101. SHORTHORN BULL, "CHOICE GOODS" 76,350.

Winner of President's Medal for best Shorthorn, Inverness Show, 1901. The property of Mr James Morson, Craigwillie, Huntly. Bred by Mr James Durno, Jackston, Rothie-Norman, Aberdeenshire. Age two years and two months.

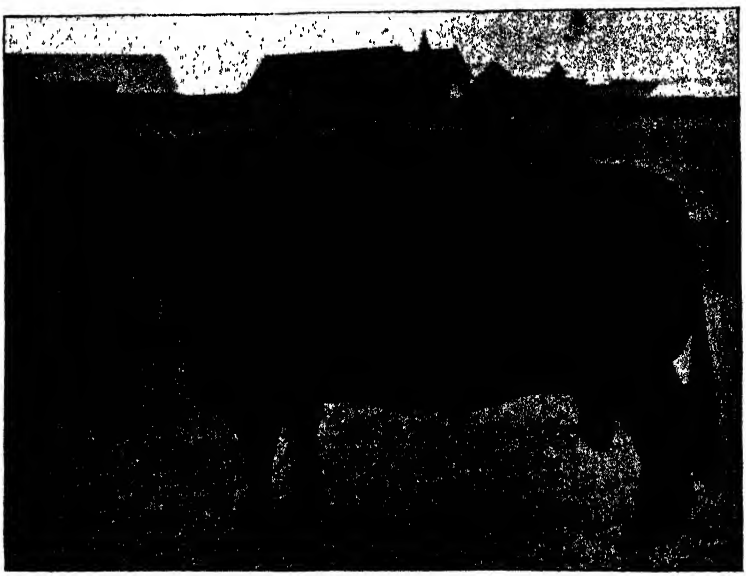

Fig. 102.—ABERDEEN-ANGUS BULL, "JIPSEY BARON" 13,532.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. The property of Mr James Whyte, Hayston, Glamis. Bred by Mr W. Whyte, Spott, Kirriemuir. Age five years.

GENERAL SHOW AT INVERNESS, 1901.

THE Society paid its ninth visit to Inverness with its annual Show in July 1901. The days of the Show were the 16th, 17th, 18th, and 19th of the month. It was the seventy-fourth Show the Society has held, and by far the most successful that has taken place in the capital of the Highlands.

Delightful weather prevailed during the week of the Show, excepting for some hours on the Friday, when rain fell heavily, causing much discomfort to visitors, and, to a slight extent, lessening the drawings for that day. On the whole, the attendance of visitors was very large, especially in view of the comparatively small population of the district. It is indeed within the truth to say that the percentage of the population of the district which attended the Show in the course of the four days was considerably larger than could be claimed by any one of the other districts in the Show circuit.

The town of Inverness provided a site free of charge in the Victoria Park, and a better and more beautifully situated site the Society has never had. The town likewise gave a supply of water free of charge, contributed 50 guineas to the Local Fund, and, along with the County Authorities and Agricultural Associations in the district, co-operated most heartily with the Society in promoting the success of the Show. The Local Fund in aid of the Show, amounting to over £1700, stands about the second highest on record; and this, together with the handsome drawings at the gates, enabled the Society for the first time in its history to exhibit a credit balance upon its Show at Inverness. The credit balance is not large—about £100, but it forms a pleasing contrast to a loss of £1089 in 1892, of £838 in 1883, and of £1401 in 1874. This result is all the more gratifying in view of the fact that the amount offered in premiums last year was close on £800 more than the sum offered in 1892.

The character of the Show in regard to the display of live stock was almost as noteworthy as was the financial result. The turn-out of cattle, alike in numbers and quality, was remarkably strong, most of the classes of horses were creditably filled, and the muster of sheep, if not large, was of very high merit. The collection of implements and machines was large for the district, and a fair amount of business was transacted in this important department of the Show.

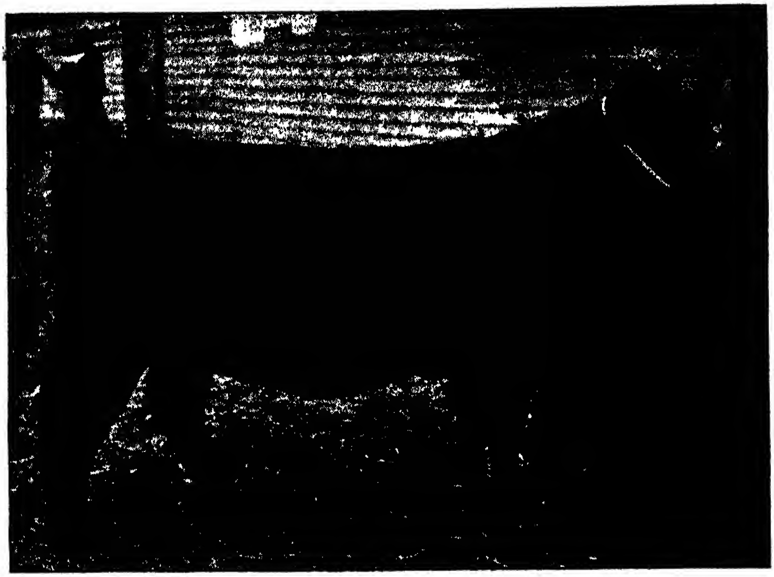

Fig. 103.—GALLOWAY HEIFER, "GRACEFUL 3RD OF GARLIESTOWN" 16,675.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. The property of Mr Andrew Montgomery, of Netherhall, Castle-Douglas. Bred by the late Earl of Galloway. Age one year and five months.

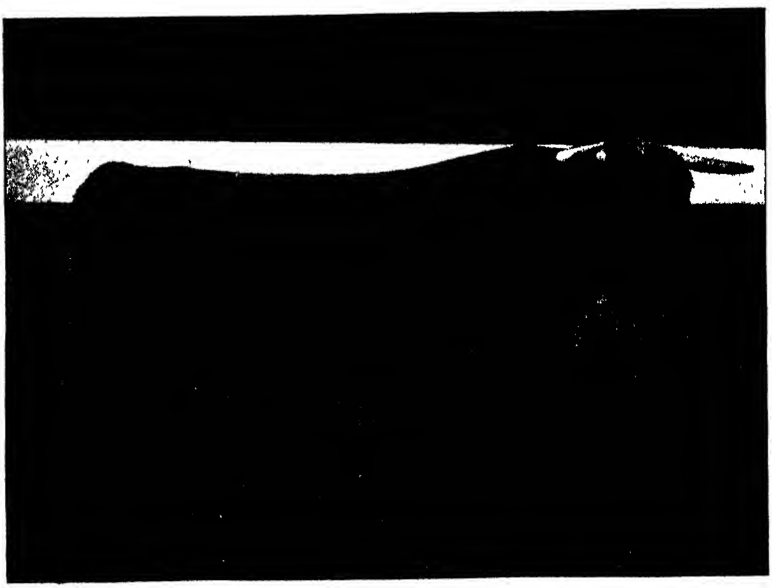

Fig. 104.—HIGHLAND BULL, "LAOCH" 1260.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. The property of Mr J. R. Campbell, Shinness, Lairg. Bred by the late Mr John Stewart of Ensay. Age seven years.

Statistics.

The following tables give the number of entries in the various sections :—

1. CATTLE.

Class.		No. of Entries.	
	SHORTHORN.		
1.	Aged bulls	18	
2.	Two-year-old bulls	24	
3.	One-year-old bulls	24	
4.	Cows of any age	13	
5.	Two-year-old heifers	13	
6.	One-year-old heifers	27	
		—	119
	ABERDEEN-ANGUS.		
7.	Aged bulls	13	
8.	Two-year-old bulls	12	
9.	One-year-old bulls	12	
10.	Cows of any age	21	
11.	Two-year-old heifers	16	
12.	One-year-old heifers	27	
		—	101
	GALLOWAY.		
13.	Aged bulls	2	
14.	Two-year-old bulls	2	
15.	One-year-old bulls	3	
16.	Cows of any age	4	
17.	Two-year-old heifers	2	
18.	One-year-old heifers	8	
		—	21
	HIGHLAND.		
19.	Aged bulls		
	Extra stock	2	
20.	Two-year-old bulls	11	
21.	One-year-old bulls	15	
22.	Cows of any age	15	
23.	Three-year-old heifers	15	
24.	Two-year-old heifers	13	
		—	79
	AYRSHIRE.		
25.	Aged Bulls. (*No entry.*)		
26.	Two-year-old bull	1	
27.	One-year-old bulls	2	
28.	Cows in milk, calved before 1898	2	
29.	Cows in milk, calved after 1st January 1898	4	
30.	Cows of any age, in calf, or heifers in calf, calved in 1898	3	
31.	Two-year-old heifers	3	
32.	One-year-old heifers	2	
		—	17
	FAT CATTLE.		
33.	Ox, any pure breed or cross, calved after 1st December 1898	5	
34.	Ox, any pure breed or cross, calved after 1st December 1899	8	
35.	Heifer, any pure breed or cross, calved after 1st December 1898	6	
36.	Heifer, any pure breed or cross, calved after 1st December 1899	4	
		—	23
			360

Fig. 105.—Ayrshire Cow, "White Rose" 12,052.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Mr W. Howie, Burnhouses, Galston. Age five years.

Fig. 106.—Shorthorn Heifer, "Gertrude II."

Winner of President's Medal for best animal in the Fat Cattle Classes, Inverness Show, 1901. Bred by and the property of Mr John Ross, Meikle Tarrel, Fearn, Ross-shire. Age two years and five months.

2. HORSES.

Draught Stallions.

37. Aged stallions	15	
38. Three-year-old entire colts	10	
39. Two-year-old entire colts	14	
40. One-year-old entire colts	17	
	—	56

Draught Geldings.

41. Aged geldings	6	
42. Three-year-old geldings	4	
43. Two-year-old geldings	2	
	—	12

Draught Mares and Fillies.

44. Mares with foal at foot	10	
45. Yeld mares, foaled before 1898	13	
Extra stock	1	
46. Three-year-old yeld mares, or fillies	10	
47. Two-year-old fillies	13	
48. One-year-old fillies	13	
Extra stock	1	
	—	61

Hunters.

49. Colt, gelding, or filly, foaled in 1900, the produce of thoroughbred stallions	8	
50. Filly, mare, or gelding, for field, foaled in 1899	9	
51. Yeld mare, filly, or gelding, for field, foaled in 1898	7	
52. Hunter, brood mare, with foal at foot, or to foal this season	9	
	—	33

Hackneys.

53. Brood mares, 15 hands and upwards, with foal at foot, or to foal this season to a registered sire	3	
54. Brood mares, under 15 hands, with foal at foot, or to foal this season to a registered sire	2	
55. Yeld mares or fillies, three years old. (*No entry.*)		
56. Fillies, two years old	2	
57. Fillies, one year old	3	
58. Stallions, foaled in or before 1898, over 15 hands	3	
59. Stallion, foaled in or before 1898, over 14 and not over 15 hands	1	
60. Entire colts, two years old	2	
61. Entire colts, one year old	4	
	—	20

Ponies.

62. Stallions, 3 years old and upwards, over 12 and not exceeding 14 hands	5	
63. Yeld mares, fillies, or geldings, 3 years old and upwards, over 13 and not over 14½ hands	6	
64. Yeld mare, filly, or gelding, 3 years old and upwards, over 12 and not over 13 hands	1	
65. Stallion, 3 years old and upwards, 12 hands and under. (*No Entry.*)		
66. Yeld mares, fillies, or geldings, 3 years old and upwards, 12 hands and under	2	
Extra stock	1	
67. Pony stallions, not exceeding 14·2 hands, best adapted to get ponies, out of Highland pony mares, suitable for mounted infantry (7)	4	
68. Highland-bred ponies, any age, yeld mares or geldings, not exceeding 14·2 hands, suitable for mounted infantry (8)	6	
Extra stock	5	
69. Shetland stallions, not exceeding 10½ hands, foaled before 1898	6	
Extra stock	2	
70. Shetland entire colt, not exceeding 10½ hands, foaled in 1898 or 1899	3	
71. Shetland mares, not exceeding 10½ hands, with foal at foot	12	
72. Shetland yeld mares, not exceeding 10½ hands	5	
73. Shetland fillies, not exceeding 10½ hands, foaled in 1898 or 1899	4	
Extra stock	4	
	—	66

Fig. 107.—CLYDESDALE COLT.

Winner of President's Medal for best Clydesdale Stallion or Colt, Inverness Show, 1901. The property of Messrs A. & W. Montgomery, Netherhall and Banks, Castle-Douglas. Bred by Mr W. M. Wood, Purston Hall, Pontefract Age one year and four months.

Fig. 108.—DRAUGHT GELDING, "PERFECTION."

Winner of President's Medal for best Draught Gelding, Inverness Show, 1901. The property of Mr W. Clark, Netherlea, Cathcart. Bred by Mr Edwin Bolton, West Plean, Bannockburn. Age four years.

Driving Competitions.

74.	Yeld mares, fillies, or geldings, in harness, 15 hands and upwards	7	
75.	Yeld mares, fillies, or geldings, in harness, under 15 hands (6)	2	9
			257

Jumping.

1.	Horses—open	11	
2.	Ponies, 14·3 hands and under	5	
3.	Horses—open handicap	9	
4.	Ponies, 14·3 hands or under—handicap	5	
5.	Horses—open handicap	8	
6.	Ponies, 14·3 hands or under—handicap	4	42

3. SHEEP.

Blackfaced.

76.	Tups above one shear	13	
77.	Shearling tups	10	
78.	Ewes above one shear, with lambs	8	
79.	Shearling ewes or gimmers	4	35

Cheviot.

80.	Tups above one shear	6	
81.	Shearling tups	8	
82.	Ewes above one shear, with lambs	5	
83.	Shearling ewes or gimmers	13	32

Border Leicester.

84.	Tups above one shear	7	
85.	Shearling tups	32	
86.	Ewes above one shear	9	
87.	Shearling ewes or gimmers	21	69

Half-bred.

88.	Tups above one shear	6	
89.	Shearling tups	11	
90.	Ewes above one shear	7	
91.	Shearling ewes or gimmers	8	32

Shropshire.

92.	Tup above one shear	1	
93.	Shearling tups	5	
94.	Ewes above one shear	3	
95.	Shearling ewes or gimmers	4	13

Oxford Downs.

96.	Shearling tups	4	
97.	Shearling ewes or gimmers	5	
	Extra stock	1	10

Suffolk.

98.	Shearling tup	1	
99.	Shearling ewes or gimmers	3	
100.	Three ewe lambs	1	5

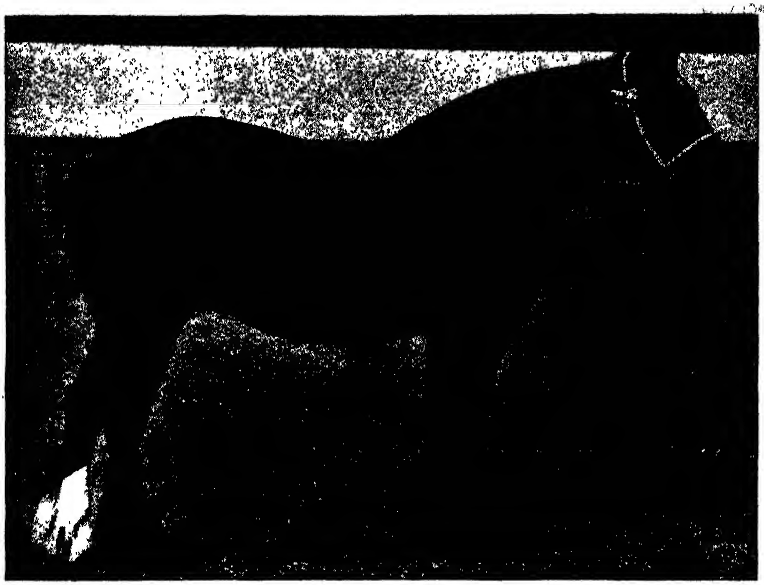

Fig. 109.—CLYDESDALE MARE, "LADY LOTHIAN" 13,319.

Winner of President's Medal for best Clydesdale Female, Inverness Show, 1901. The property of Mr Herbert Webster, Morton House, Fence Houses. Bred by Mr Richard Little, Wormanby, Carlisle. Age eight years.

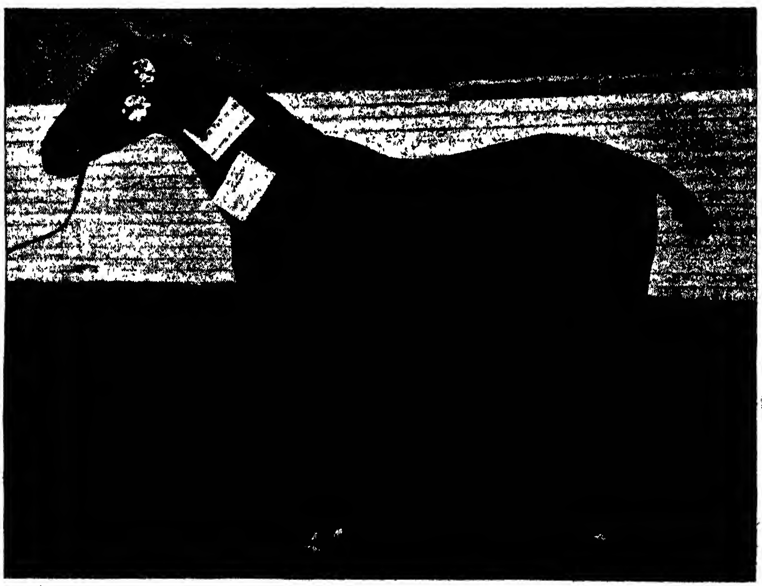

Fig. 110.—HUNTER GELDING, "CROSSBURN."

Winner of President's Medal for best Hunter, Inverness Show, 1901. Bred by and the property of Mr D. Stevenson, Crossburn, Troon. Age three years and three months.

EXTRA SECTIONS.

101.	Fat lambs, any breed or cross	5	
	Extra stock	3	
		—	8
			204

4. WOOL.

102.	Blackface wether wool	5	
103.	Blackface ewe wool	9	
104.	Blackface ewe or wether hogg wool	8	
		—	22

5. SWINE.

105.	Boars, large white breed	4	
106.	Sows, large white breed	4	
107.	Pigs not above 8 months old, large white breed	4	
108.	Boar, white breed other than large	1	
109.	Sow, white breed other than large	2	
110.	Pigs not above 8 months old, white breed other than large. (*No entry.*)		
111.	Boars, Berkshire breed	3	
112.	Sows, Berkshire breed	2	
113.	Pigs not above 8 months old, Berkshire breed	2	
		—	22

6. POULTRY.

1–80	Poultry	499

7. DAIRY PRODUCE.

1.	Cured butter, not less than 7 lb.	10	
2.	Powdered butter, not less than 7 lb.	10	
3.	Fresh butter, 3 1-lb. rolls	16	
4.	Cheddar Cheese, 56 lb. and upwards	3	
5.	Cheddar Cheese, 14 lb. and under	3	
		—	42

ABSTRACT.

	No. of Entries.
1. Cattle	360
2. Horses	257
3. Sheep	204
4. Wool	22
5. Swine	22
6. Poultry	499
7. Dairy produce	42

The following table gives a comparative view of the display of cattle, horses, sheep, swine, poultry, dairy produce, and implements, of the value of the premiums offered, and of the

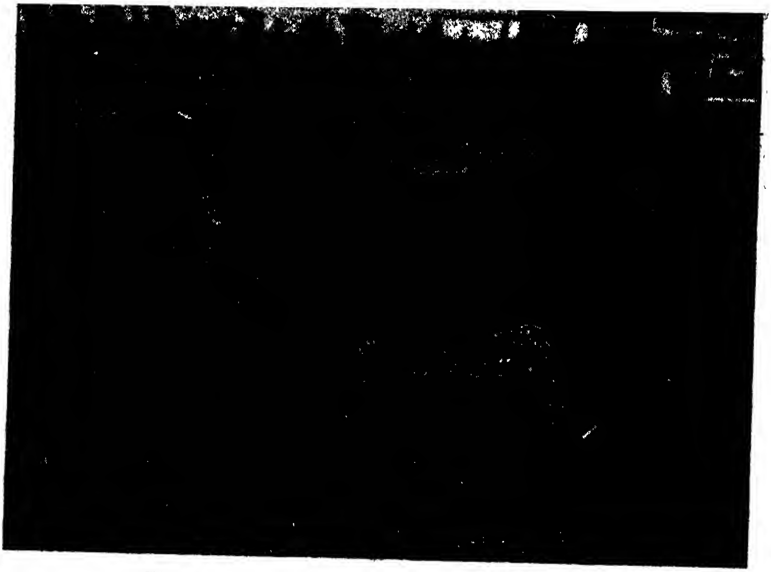

Fig. 113.—SHETLAND PONY MARE "SKYLARK."

Winner of President's Medal for best Shetland Pony, Inverness Show, 1901 The property of Mrs Wentworth Hope Johnstone, Skeyness, Edenbridge, Kent. Bred by the Marquis of Londonderry. Age eight years.

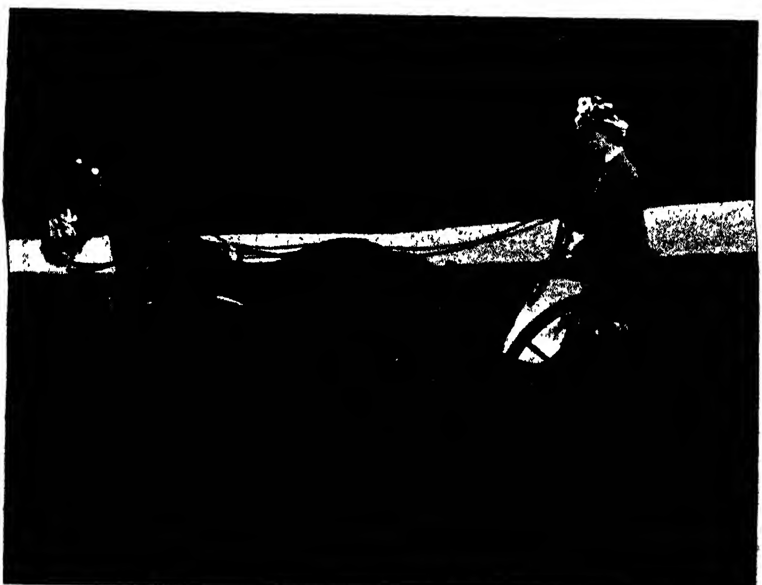

Fig. 114.—GELDING IN HARNESS.

Winner of President's Medal for best animal in Classes for Horses in Harness, Inverness Show, 1901. The property of Mr James Prentice, Carolside, Uddingstone. Bred by Mr J. W. Neill, Barfield House, York. Age five years.

bulls there were no fewer than 66 entries, two more than the total number of entries of Shorthorns in 1892. There was abundance of merit in each of the three classes, but the champion of the breed was found amongst the two-year-old bulls. This was Mr James Merson's handsome roan bull "Choice Goods" 76,350 (fig. 101), which was bred by Mr James Durno, Jackston, Aberdeenshire, got by "Remus" 73,402, and out of "Geraldine 5th" by "First Choice" 58,950. The class of old bulls, which numbered 18, made a specially strong display before the judges, while in the two younger classes, which contained 24 entries each, there were many attractive sires, well fitted to maintain the high character of Scotch Shorthorns.

The classes of Shorthorn cows and heifers were also well filled, and all over the standard of merit was high. The special prize for the best Shorthorn female went to Lord Lovat for "Beaufort Pride 3rd," a big handsome two-year-old roan, bred by his lordship, and got by "Royal Star" 71,502.

Aberdeen-Angus cattle were scarcely so numerous as Shorthorns, yet they ran into three figures. Here again a very high standard of merit was reached, all the classes being strong both as to numbers and quality. The President's Medal for the best animal of the breed went to Mr James Whyte, Hayston, Glamis, for "Jipsey Baron" 13,532 (fig. 102), a well-shaped five-year-old bull of excellent all-round merit, bred by Mr W. Whyte, Spott, Kirriemuir, got by "Junior Rover" 11,796, and out of "Judy 2nd" 7960. The younger classes of Aberdeen-Angus bulls included some animals of exceptional promise, and this remark would also apply to the heifer classes of this breed. Polled cows made up a particularly creditable class.

Although Galloway cattle were few in number, the section contained a few admirable specimens of the breed. The President's Medal went to Mr Andrew Montgomery for "Graceful 3rd of Garliestown" 16,675 (fig. 103), a handsomely shaped stylish yearling heifer bred by the late Earl of Galloway.

Highland cattle as usual formed one of the most attractive and strongest features of the Show. The entries were numerous, and, as to merit, the breed was most creditably represented. Once again that grand bull "Laoch" 1260 (fig. 104) carried off the President's Medal for the best animal of the breed.

There was a small but choice muster of Ayrshire cattle. A worthy champion of this breed was found in Mr W. Howie's grand five-year-old cow "White Rose" 12,052 (fig. 105). She was bred by himself, got by "Sloth Boy of Burnhouses" 3966, and out of "White Rose I. of Burnhouses" 10,406.

The four classes of fat cattle were creditably filled. Mr John Ross, Meikle Tarrel, Ross-shire, won the President's Champion Medal here with "Gertrude II." (fig. 106), a handsome two-year-

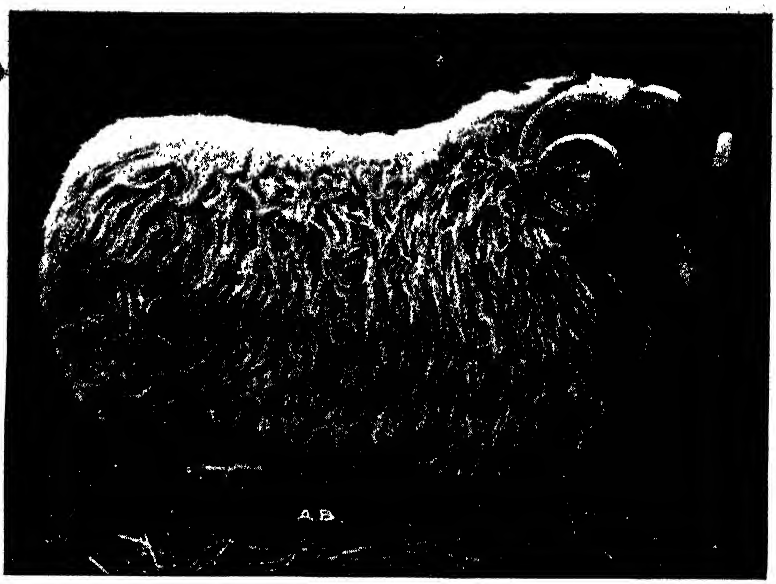

Fig. 115.—BLACKFACED TUP.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Mr J. Archibald, Overshiels, Stow. Age two shear.

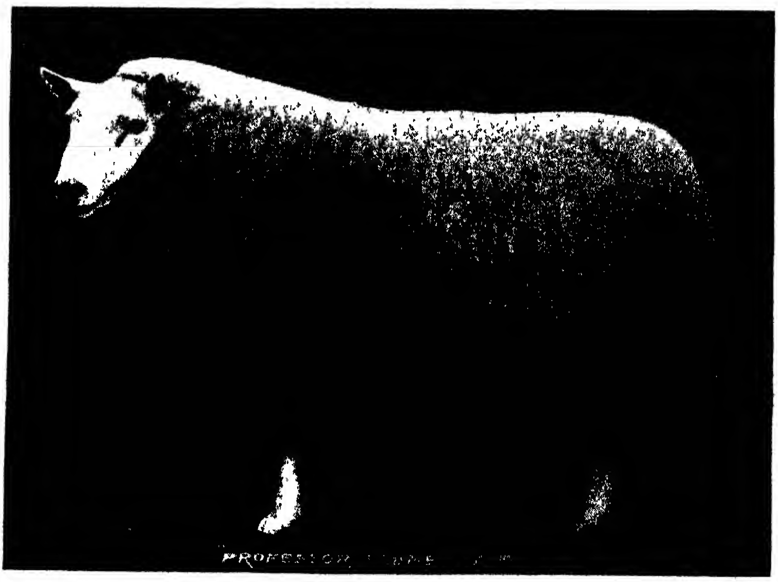

Fig. 116.—CHEVIOT TUP, "PROFESSOR PLUMB."

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Mr John Elliot, Hindhope, Jedburgh. Age two shear.

old roan Shorthorn bred by himself, got by the famous sire "Ringleader" 64,663, and out of "Gertrude" by "Champion" 66,801.

Horses.

There has been but one opinion expressed regarding the show of Clydesdale horses. It was undoubtedly one of the best of recent years. Messrs A. & W. Montgomery again carried off the President's Champion Medal for the best Clydesdale colt or stallion, this time with an exceptionally promising yearling bay colt (fig. 107), bred by Mr W. M. Wood, Purston Hall, Pontefract, got by "Baron's Pride" 9122, and out of "Rose" 13,328 by "Prince of Galloway" 8919.

Draught geldings were few in number but of high merit. Mr W. Clark got the President's Medal for "Perfection" (fig. 108), a handsome four-year-old grey bred by Mr E. Bolton, West Plean, Bannockburn, and the winner of the same honour at Stirling in 1900.

Strong as were the classes of Clydesdale males, the Clydesdale female classes were perhaps still stronger. Both amongst males and fillies merit was high, and the leading honours were keenly contested for. As at Stirling in 1900 Mr Herbert Webster won both the President's Medal and the Cawdor Challenge Cup for the best Clydesdale mare or filly with his grand eight-year-old brown mare "Lady Lothian" 13,319 (fig. 109), a very close runner-up on this occasion being Mr Alexander Guild's handsome mare "Lady Margaret" 13,833, which so worthily headed the class of yeld mares.

As was to be expected, the turn out of Hunters was small, yet there were amongst them a few animals of high merit. The President's Medal went to Mr D. Stevenson for "Crossburn" (fig. 110), a good-looking three-year-old chestnut of his own breeding, got by "Child of the Mist."

Hackneys were even fewer in number than Hunters, only 20 having been entered. As to general merit the display was fairly satisfactory. Mr Alfred A. Haley won the President's Champion Medal with his very useful seven-year-old chestnut mare "Welwick Bright Merry" 13,175 (fig. 111), bred by Mr E. Clark, got by "Diviner" 3543, and out of "Dinah" 6574 by "Frodingham Performer" 289.

A fair number of Ponies were exhibited in one or other of the classes, and a most interesting and popular display they made. Mr Alexander Morton's attractive mare "Fiona" 10,918 (fig. 112), which won the President's Medal for the best animal in the Pony classes, was universally admired, and so also was Mrs Wentworth Hope Johnstone's beautiful Shetland pony mare

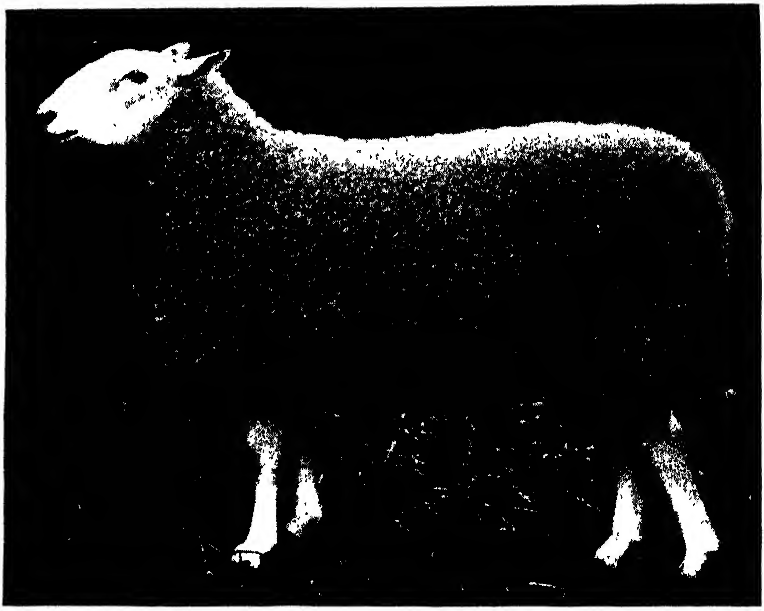

Fig. 117.—Border Leicester Tup.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Mr David Hume, Barrelwell, Brechin. Age one shear.

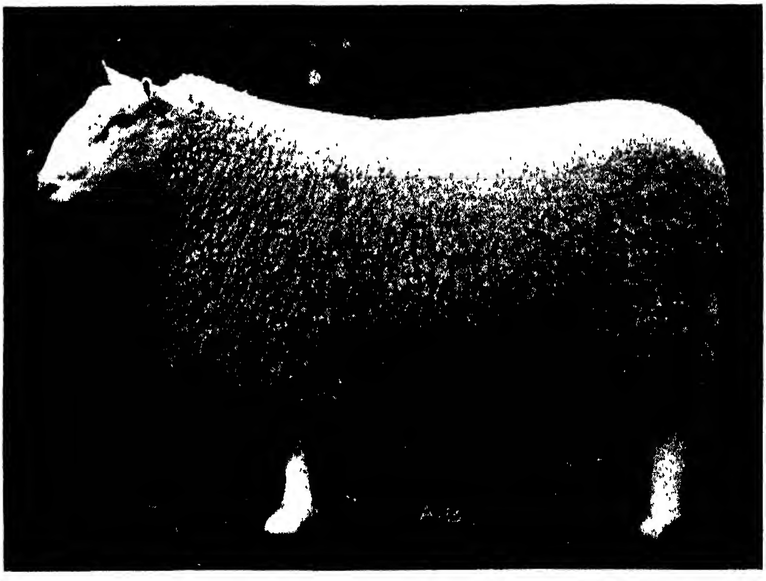

Fig. 118.—Half-bred Tup.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901 Bred by and the property of Mr A. T. Elliot, Newhall, Galashiels. Age one shear.

"Skylark" (fig. 113), which carried off the President's Champion Medal for Shetland ponies.

Specially interesting classes were those in which were shown (1) Ponies competing for Lord Tweedmouth's prize of £20 for the "Pony Stallion, not exceeding 14·2 hands, best adapted to get ponies, out of Highland pony mares, suitable for Mounted Infantry," and (2) Highland-bred Ponies, any age, yeld mare or gelding, not exceeding 14·2 hands, suitable for Mounted Infantry"—the prizes in this latter class also being given by Lord Tweedmouth. In the former class the highest honour was adjudged to Lord Tweedmouth's own handsome five-year-old hackney pony stallion "Miracle," bred by the Marquis of Londonderry, got by "Little Wonder 2nd" 1610, and out of "Queen of Tyne." His lordship returned to the Society the premium of £20, to be again competed for at the Aberdeen Show of 1902, but arranged for his pony stallion to serve a certain number of mares in the Northern Counties as provided in the conditions for the Inverness Show. There were eight entries in the class for Highland-bred Ponies, and a fairly good lot they were. The awards had, of course, to be made with due regard to the condition that the ponies were to be "suitable for Mounted Infantry."

The display in the driving competition was as usual highly attractive, the President's Champion Medal going to Mr James Prentice for "Bothwell Squire" (fig. 114), a handsome five-year-old chestnut gelding, bred in Yorkshire by Mr J. W. Neill, got by "Agility" 2799, and out of "Jenny Lind" 3950. Mr Fletcher's special prize of £10, 10s. for the best four-in-hand team of Shetland ponies went to Mrs Wentworth Hope Johnstone for a beautifully matched team, which excited great interest and admiration during the Show.

Sheep, &c.

In some of the classes of Sheep a larger turn out might have been looked for at a Show in the Northern Counties, but in regard to merit the display was highly creditable. The winners of the President's Champion Medals are represented in figs. 115 to fig. 121. Swine were fairly good, dairy produce very good, and poultry excellent.

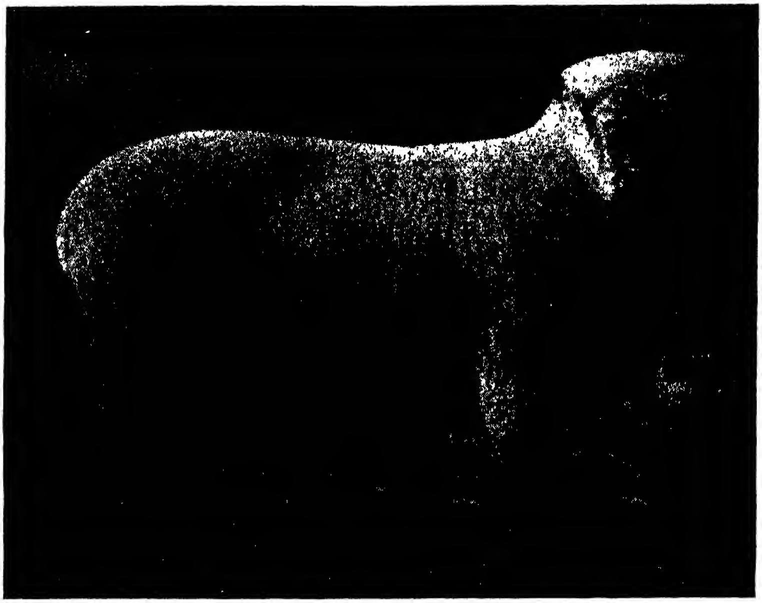

Fig. 119.—Shropshire Tup.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of the Earl of Strathmore, Glamis Castle, Forfar. Age one shear.

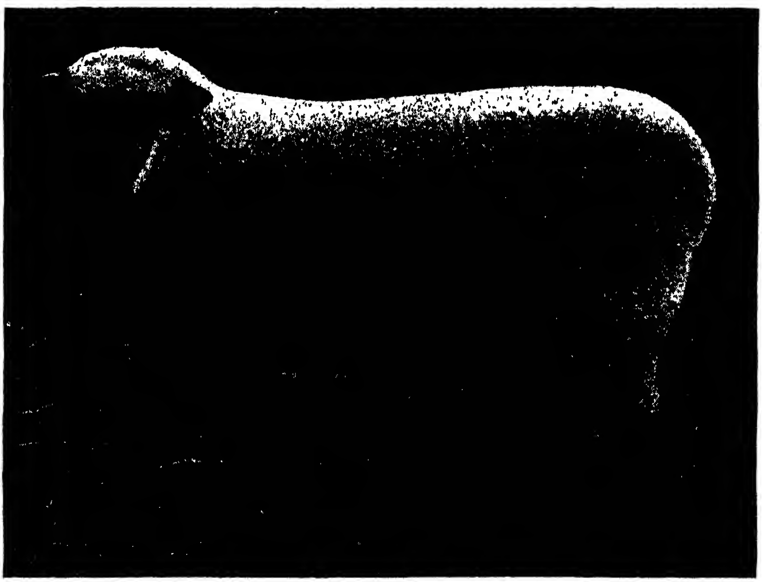

Fig. 120.—Oxford Down Tup.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Mr Walter Elliot, Hollybush, Galashiels. Age one shear.

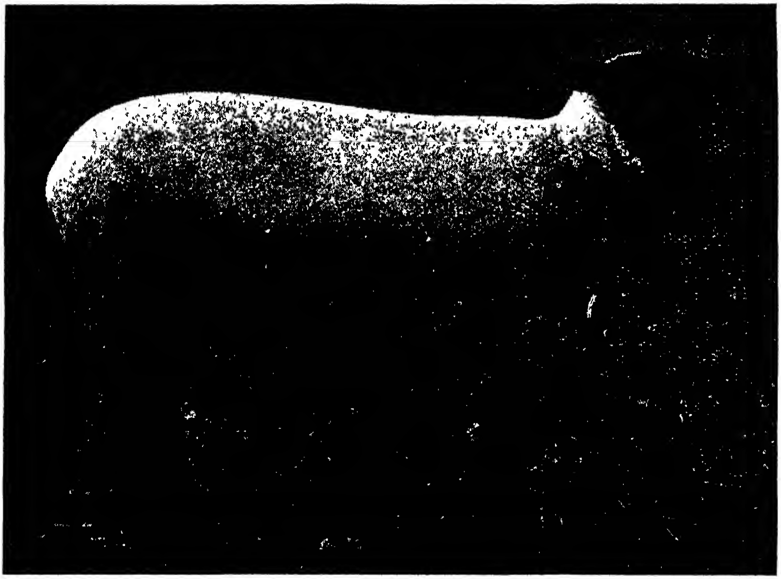

Fig. 121.—SUFFOLK EWE.

Winner of President's Medal for best animal of the breed, Inverness Show, 1901. Bred by and the property of Major E. W. Baird, Exning House, Newmarket. Age one shear.

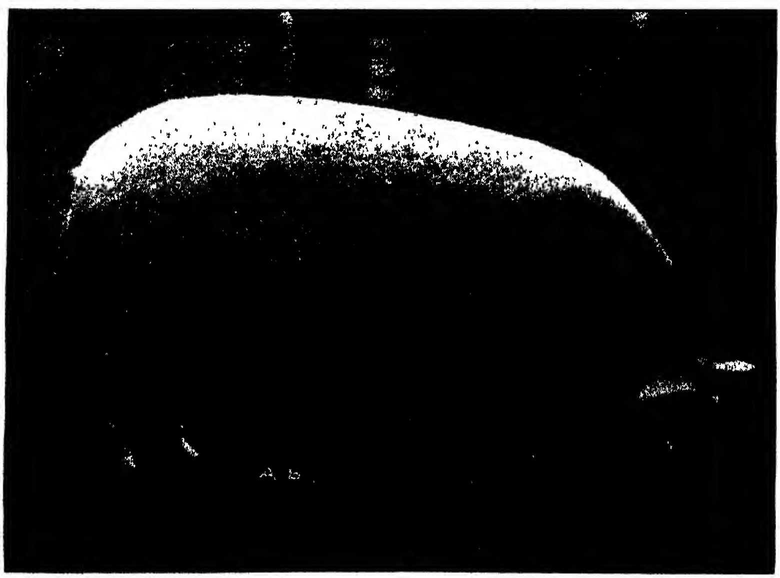

Fig. 122.—LARGE WHITE BOAR, "HOLYWELL HUGH."

Winner of President's Medal for best Pig, Inverness Show, 1901. Bred by and the property of Mr Sanders Spencer, Holywell Manor, St Ives, Hunts. Age one year and eleven months.

PREMIUMS AWARDED BY THE SOCIETY IN 1901.

I.—INVERNESS SHOW

16th, 17th, 18th, and 19th July 1901.

ABBREVIATIONS.—V., *Very Highly Commended.* H., *Highly Commended.* C., *Commended.*

CATTLE

SHORTHORN.

PRESIDENT'S CHAMPION MEDAL for best Shorthorn.

James Merson, Craigwillie, Huntly, N.B., "Choice Goods" (76,350).

Tweeddale Gold Medal, value £20, for best Shorthorn Bull.

James Merson, Craigwillie, Huntly, N.B., "Choice Goods" (76,350).

Best Shorthorn in Classes 1 *to* 6—Champion Prize of £20, given by Shorthorn Breeders in the Counties of Inverness and Ross.

James Merson, Craigwillie, Huntly, N.B., "Choice Goods" (76,350).

Breeder of best Bull of any age in Classes 1, 2, *and* 3—The Silver Medal.

James Durno, Jackston, Rothie-Norman, N.B.

CLASS 1. BULL, calved before 1899.—Premiums, £15, £10, £5, and £3.

1. George Harrison, Gainford Hall, Darlington, "Inspector" (72,715).
2. John Wilson, Lower Pirriesmill, Huntly, "Golden Star" (76,799).
3. John Handley, Green Head, Milnthorpe, "Moonlight" (75,110).
4. The Rev. J. A. Dunbar Dunbar, Pitcraigie Farm, Glen of Rothes, and Sea Park, Forres, "White Duke" (73,885).

V. George Shepherd, Shethin, Tarves, Aberdeenshire, "Waterloo Ensign" (78,119).
H. John Cran, Keith, "Abbotsford 2nd" (69,838).
C. T. A. Anderson, Ballachraggan, Alness, "Challenger" (74,199).
C. George Walker, jun., Tillygreig, Udny Station, "Pride of the Realm" (75,251).

CLASS 2. BULL, calved in 1899.—Premiums, £15, £10, £5, and £3.

1. James Merson, Craigwillie, Huntly, N.B., "Choice Goods" (76,350).
2. Robert Macfarlane, Tomich, Invergordon, "Margrave."
3. William Bell, Ratcheugh, Alnwick, "Baron Abbotsford."
4. John Granger, Pitcur, Coupar-Angus, "Count Nicholas" (76,435).

V. J. Maxtone Graham, Battleby, Redgorton, Perth, "White Archer" (78,144).
H. George Harrison, Gainford Hall, Darlington, "Gainford Rising Star" (76,727).
C. William T. Malcolm, Dunmore, by Larbert, "Ajax of Cluny."

CLASS 3. BULL, calved in 1900.—Premiums, £12, £8, £4, and £2.

1. Sir John Gilmour of Montrave, Bart., Leven, Fife, "Royal Archer."
2. George Harrison, Gainford Hall, Darlington, "Silver Bell."
3. Captain Graham-Stirling of Strowan, Crieff, "Cock Robin."
4. William Bell, Ratcheugh, Alnwick, "Baron's Pride."

V. Duncan Stewart of Millhills, Crieff, "Strathearn Lad."
H. William Wilson, Coynachie, Gartly, N.B., "Golden Fancy."
C. William T. Malcolm, Dunmore, by Larbert, "Gilderoy" (78,963).
C. Colonel John Gordon Smith, Minmore, Glenlivet, Ballindalloch, "Young Wanderer."

Best Female in Classes 4, 5, *and* 6—£20 given by the Shorthorn Society.

Lord Lovat, Beaufort, Beauly, "Beaufort Pride 3rd."

CLASS 4. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. Captain Graham-Stirling of Strowan, Crieff, "Strowan Marchioness V."
2. J. Douglas Fletcher of Rosehaugh, Avoch, "Amazon."
3. John Cran, Keith, "Merry Girl 6th."
4. Lord Polwarth, Mertoun House, St Boswells, "Cowslip Blossom."

V. C. M. Cameron, Balnakyle, Munlochy, N.B., "Maggie 6th."
H. William T. Malcolm, Dunmore, by Larbert, "Strawberry 42nd."

CLASS 5. HEIFER, calved in 1899.—Premiums, £10, £5, £3, and £2.

1. Lord Lovat, Beaufort, Beauly, "Beaufort Pride 3rd."
2. Lord Lovat, Beaufort, Beauly, "Polly Lind."
3. Captain Graham-Stirling of Strowan, Crieff, "Bracelet III."
4. James M'William, Stoneytown, Keith, "Hilda."

V. C. M. Cameron, Balnakyle, Munlochy, R.S.O., "Merrylass 6th."
H. Lord Polwarth, Mertoun House, St Boswells, "Dame Hurry."
C. William T. Malcolm, Dunmore, by Larbert, "Kathleen."

CLASS 6. HEIFER, calved in 1900.—Premiums, £10, £5, £3, and £2.

1. A. Robertson, Haugh of Ballechin, Ballinluig, "Lovely Tulip."
2. William & J. W. Peterkin, Dunglass, Conon Bridge, "Cherry Leaf 3rd."
3. J. Douglas Fletcher of Rosehaugh, Avoch, "Coral Fairy."
4. Lord Lovat, Beaufort, Beauly, "Gazelle."

V. Colonel Munro, Mains of Murthly, Aberfeldy, "Lattice Leaf."
H. P. B. Macintyre, Findon Mains, Conon Bridge, "Lady Violet 2nd."
C. C. M. Cameron, Balnakyle, Munlochy, "Butterfly 32nd."
C. James M'William, Stoneytown, Keith, "Golden Lily."

ABERDEEN-ANGUS.

PRESIDENT'S CHAMPION MEDAL for best Aberdeen-Angus Animal.

James Whyte, Hayston, Glamis, "Jipsey Baron" (13,532).

Best Bull of any age in Classes 7, 8, *and* 9—Ballindalloch Challenge Cup, value £50, given by Sir George Macpherson Grant, Bart.

James Whyte, Hayston, Glamis, "Jipsey Baron" (13,532).

Breeder of best Bull of any age in Classes 7, 8, *and* 9—The Silver Medal.

William Whyte, Spott, Kirriemuir.

Best Breeding Animal of the Breed—Champion Gold Medal, given by the Polled Cattle Society.

James Whyte, Hayston, Glamis, "Jipsey Baron" (13,532).

Breeder of the Winner of the Ballindalloch Challenge Cup—Silver Medal.

William Whyte, Spott, Kirriemuir.

Class 7. BULL, calved before 1st December 1898.—
Premiums, £15, £10, £5, and £3.

1. James Whyte, Hayston, Glamis, "Jipsey Baron" (13,532).
2. Thomas F. Inkson, Kinermony, Aberlour, Strathspey, "Jim of Morlich" (13,531).
3. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Delamere" (13,305).
4. C. W. Dyson Perrins, Ardross Castle, Alness, "Rosador" (15,996).
V. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Eblito" (14,306).
H. John Macpherson, Mulben, Keith, "Erica Prince, E" (14,357).
C. William Fettes, Corskie, Garmouth, "Marcus of Inverfiddich" (13,651).
C. Fitzroy C. Fletcher of Letham Grange and Fern, Arbroath, "Enterprise of Aberlour" (15,407).

Class 8. BULL, calved on or after 1st December 1898.—
Premiums, £15, £10, £5, and £3.

1. Colonel Charles M'Inroy, C.B., of The Burn, Edzell, "Ben Vrackie" (16,290).
2. Alexander M'Laren, Auchnaguie, Tullymet, Ballinluig, "Ben Gloe" (17,504).
3. John Findlay of Aberlour, "Performer of Aberlour" (17,018).
4. The Earl of Strathmore, Glamis Castle, Forfar, "Veneer" (18,634).
V. Hugh Wilson, Milton of Noth, Rhynie, Aberdeenshire, "Dauntless 3rd of Noth" (16,440).
C. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Klondyke of the Burn" (16,748).
C. Garden A. Duff of Hatton, Turriff, "Expert of Advie" (17,821).
C. W. S. Ferguson, Kinochtry, Coupar-Angus, "Jugurtha of Kinochtry" (16,727).

Class 9. BULL, calved on or after 1st December 1899.—
Premiums, £12, £8, £4, and £2.

1. John Macpherson, Mulben, Keith, "Juba of Morlich" (17,986).
2. George R. Sharp, Bardrill, Blackford, "Just Rover of Morlich 2nd" (18,000).
3. Thomas H. Bainbridge, Eshott Hall, Felton, Northumberland, "Maramere" (18,160).
4. Alexander M'Laren, Auchnaguie, Tullymet, Ballinluig, "Magersfontein" (18,137).
V. James Kennedy, Doonholm, Ayr, "Mondamin" (18,240).
H. His Majesty the King, Abergeldie Mains, Ballater, "Elandslaagte" (17,745).
H. C. Bolden, Preston Bissett, Buckingham, "St Ronan" (18,532).
H. William Watt, Middlefield, Cupar, "Senamere" (18,552).

Best Cow of any age in Class 10—Ballindalloch Challenge Cup, value £50, given by the late Mr C. Macpherson Grant of Drumduan.

The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Effie of Dalmeny" (25,983).

Breeder of the Winner of the Ballindalloch Challenge Cup—Silver Medal.

The Earl of Rosebery, K.G.

Class 10. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Effie of Dalmeny" (25,983).
2. Thomas Smith, Powrie, Dundee, "Pride of Powrie 9th" (26,098).
3. The Earl of Strathmore, Glamis Castle, Forfar, "Estelle" (24,824).
4. His Majesty the King, Abergeldie Mains, Ballater, "Gem of Abergeldie" (27,816).
V. His Majesty the King, Abergeldie Mains, Ballater, "Mary of Abergeldie" (25,004).
H. Thomas Smith, Powrie, Dundee, "Witch of Endor 36th" (27,544).
H. Thomas H. Bainbridge, Eshott Hall, Felton, Northumberland, "Jipsey of Benton 4th" (26,125).
H. James W. H. Grant, Wester Elchies, Aberlour, "Mary of Elchies" (28,494).

Class 11. HEIFER, calved on or after 1st December 1898.—
Premiums, £10, £5, £3, and £2.

1. The Earl of Strathmore, Glamis Castle, Forfar, "Bonnet" (29,275).
2. Thomas H. Bainbridge, Eshott Hall, Felton, Northumberland, "Neat Nellie" (29,426).

3. W. S. Ferguson, Kinochtry, Coupar-Angus, "Opening Rose" (28,303).
4. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff, "Tartan Plead" (28,578).
V. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Ebbtide of Ballindalloch" (28,470).
H. His Majesty the King, Abergeldie Mains, Ballater, "Guendolin" (29,499).
H. William Wilson, Coynachie, Gartly, N.B., "Pride of Coynachie 5th" (29,488).

CLASS 12. HEIFER, calved on or after 1st December 1899.—
Premiums, £10, £5, £3, and £2.

1. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Effie of Dalmeny 4th" (30,764).
2. The Earl of Strathmore, Glamis Castle, Forfar, "Preciosa of Glamis" (30,940).
3. The Earl of Strathmore, Glamis Castle, Forfar, "Layia" (30,937).
4. Thos. H. Bainbridge, Eshott Hall, Felton, Northumberland, "Pearl of Wellhouse" (30,383).
V. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Eblanita" (30,132).
H. Garden A. Duff of Hatton, Turriff, "Daffodil Duchess 10th" (31,677).
H. George Bruce, Tochineal, Cullen, "Effie of Tochineal" (29,695).
H. Colonel Chas. M'Inroy, C.B., of The Burn, Edzell, "Guláb" (30,501).
C. George Bruce, Tochineal, Cullen, "Lovely of Tochineal" (29,699).
C. Alexander M'Laren, Auchnaguie, Tullymet, Ballinluig, "Eramera" (30,533).
C. The Earl of Strathmore, Glamis Castle, Forfar, "Elegy of Glamis" (30,934).

GALLOWAY.

PRESIDENT'S CHAMPION MEDAL for best Galloway.

Andrew Montgomery, Nether Hall, Castle Douglas, "Graceful 3rd of Garliestown" (16,675).

Breeder of best Bull of any age in Classes 13, 14, *and* 15—The Silver Medal.

The late James Cunningham, Tarbreoch, Dalbeattie.

CLASS 13. BULL, calved before 1st December 1898.—
Premiums, £15, £10, £5, and £3.

1. Robert Wilson, Kilquhanity Farm, Dalbeattie, "Macdougall 4th of Tarbreoch" (6841).
2. Robert Graham, Kirkconnel, Ringford, "Marmion of Barsalloch" (6927).

CLASS 14. BULL, calved on or after 1st December 1898.—
Premiums, £15, £10, £5, and £3.

1. David Brown, Stepford, by Auldgirth, Dumfries, "Camp-Follower of Stepford" (7476).
2. Thomas Graham, Marchfield, Dumfries, "Frederick of Tarbreoch" (7540).

CLASS 15. BULL, calved on or after 1st December 1899.—
Premiums, £12, £8, £4, and £2.

1. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Excelsior" (7702).
2. William Barbour, Troquhain, New Galloway, "Mackenzie of Kilquhanity" (7863).
3. Robert Graham, Kirkconnel, Castle Douglas, "Guiding Hand" (78,130).

CLASS 16. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Baroness 2nd of Tarbreoch" (14,748).
2. Robert Graham, Kirkconnel, Castle Douglas, "Maggie 9th of Tarbreoch" (14,403).
3. The Countess of Carlisle, Naworth Castle, Brampton, "Lady Ogilvie 5th of Naworth" (14,759).
4. The Countess of Carlisle, Naworth Castle, Brampton, Cumberland, "Semiramis 7th of Naworth" (15,442).

CLASS 17. HEIFER, calved on or after 1st December 1898.—
Premiums, £10, £5, £3, and £2.

1. Robert Wilson, Kilquhanity Farm, Dalbeattie, "Maggie of Kilquhanity" (16,295).
2. John Brown, Threecrofts, Lochfoot, Dumfries, "Moss Rose of Tarbreoch" (16,134).

CLASS 18. HEIFER, calved on or after 1st December 1899.—
Premiums, £10, £5, £3, and £2.

1. Andrew Montgomery, Nether Hall, Castle Douglas, "Graceful 3rd of Garliestown" (16,675).
2. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lady Stanley 12th of Chapelton" (16,424).
3. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Belinda 2nd of Hensol" (16,509).
4. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lady Stanley 13th of Chapelton" (16,425).

V. Andrew Montgomery, Nether Hall, Castle Douglas, "Giglot 2nd of Garliestown" (16,679).
H. The Countess of Carlisle, Naworth Castle, Brampton, Cumberland, "Beatrice 2nd of Naworth" (16,717).
C. Robert Graham, Kirkconnel, Castle Douglas, "Canty of Kirkconnel" (16,505).

HIGHLAND.

PRESIDENT'S CHAMPION MEDAL for best Highland Animal.

J. R. Campbell, Shinness, Lairg, "Laoch" (1260).

Best Animal in Classes 19 *to* 24 - Champion Cup, value £10, given by
Mr L. A. Macpherson of Corrimony.

The Duke of Atholl, K.T., Blair Castle, Blair Atholl, "Calum Buidhe of Atholl" (1475).

Breeder of best Bull of any age in Classes 19, 20, *and* 21—The Silver Medal.

The Duke of Atholl, K.T., Blair Castle, Blair Atholl.

CLASS 19. BULL, calved before 1899.—Premiums, £15, £10, £5, and £3.

1. The Duke of Atholl, K.T., Blair Castle, Blair Atholl, "Calum Buidhe of Atholl" (1475).
2. D. T. Martin, Dunlossit, Port Askaig, Isle of Islay, "Percy" (1407).
3. Representatives of the late John Stewart of Ensay, Portree, "Rhu-na-Scarbh" (1410).
4. John R. Moreton Macdonald of Largie, Largie Castle, Tayinloan, Argyllshire, "Raoghal Riabhach-n-Laragaidh."

V. John Stirling Ainsworth of Ardanaiseig, Kilchrenan, "An' Sergean II." (1451).
H. W. M. Guthrie, M.P., Duart Castle, Craignure, Isle of Mull, "Arbuthnot" (1313).

CLASS 20. BULL, calved in 1899.—Premiums, £15, £10, £5, and £3.

1. George Bullough, Isle of Rum, Oban, "Ossian Riabhach of Atholl" (1568).
2. Representatives of the late John Stewart of Ensay, Portree, "An Gille Og."
3. Lord Willoughby de Eresby, Glenartney Forest, Comrie, "Victor XXII." (1600).
4. J. R. Campbell, Shinness, Lairg, N.B., "Benbraggie."

V. John R. Moreton Macdonald of Largie, Largie Castle, Tayinloan, Argyllshire "Somhairle-n-Laragaidh" (1587).
H. Thomas V. Smith of Ardtornish, Morvern, R.S.O., "Valentine 17th" (1595).
C. Lord Willoughby de Eresby, Glenartney Forest, Comrie, "Hector Dheualach."

CLASS 21. BULL, calved in 1900.—Premiums, £12, £8, £4, and £2.

1. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Sir Andrew."
2. George Bullough, Isle of Rum, Oban, "An Ghille Ruadh."
3. J. R. Campbell, Shinness, Lairg, N.B., "Suilven."

4. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Valentine 18th."
V. J. Campbell of Kilberry, Argyllshire, "Lasgaire."
H. John Stirling Ainsworth of Ardanaiseig, Kilchrenan, "Rob Riabhach 2nd of Ardanaiseig."
C. The Countess Dowager of Seafield, Castle Grant, Grantown-on-Spey, "MacDonnag Buidhe of Atholl."

CLASS 22. COW, of any age, in Milk, or with Calf at Foot.—Premiums, £12, £8, £4, and £2.

1. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Lady Ruth" (4245).
2. The Duke of Atholl, K.T., Blair Castle, Blair Atholl, "Bean Bhuidhe 2nd of Atholl" (3892).
3. Representatives of the late John Stewart of Ensay, Portree, "Laochag Bhuidhe I." (4289).
4. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Mairi Buidhe IV." (3801).
V. A. D. & D. M'Gregor, Kinlochmoidart, Moidart, R.S.O., "Bhan-a-Mhuileach IV. of Kinlochmoidart" (3658).
H. The Countess Dowager of Seafield, Castle Grant, Grantown-on-Spey, "Tina II. of Seafield" (4207).
C. Lord Malcolm of Poltalloch, Lochgilphead, "Ealasaid Bhuidhe of Poltalloch" (4641).

CLASS 23. HEIFER, calved in 1898.—Premiums, £10, £5, £3, and £2.

1. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "May Queen V." (1796).
2. J. R. Campbell, Shinness, Lairg, N B., "Mary of Melford."
3. Charles James Murray of Lochcarron, M.P., Courthill House, Lochcarron, "Ban Sealgair II."
4. Charles James Murray of Lochcarron, M.P., Courthill House, Lochcarron, "Tarageal Carronach."
V. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Sgiathach XXVI. of Ardtornish."
H. The Duke of Atholl, K.T., Blair Castle, Blair Atholl, "Te Riabhach 4th of Atholl."
C. Representatives of the late John Stewart of Ensay, Portree, "Donnach."

CLASS 24. HEIFER, calved in 1899.—Premiums, £10, £5, £3, and £2.

1. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Lady Dorian" (4816).
2. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Lady Mary Malvina" (4820).
3. William Dalziel Mackenzie of Farr, Daviot, Inverness, "Bhean Ogg II. of Farr."
4. William Dalziel Mackenzie of Farr, Daviot, Inverness, "Mairi Ogg III. of Farr."
V. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Minnie of Ardtornish."
H. The Duke of Atholl, K.T., Blair Castle, Blair Atholl, "Annag Riabhach 7th of Atholl."
C. Charles James Murray of Lochcarron, M.P., Courthill House, Lochcarron, "Ostaig IV."

AYRSHIRE.

PRESIDENT'S CHAMPION MEDAL for best Ayrshire.

William Howie, Burnhouses, Galston, "White Rose" (12,052).

Breeder of best Bull of any age in Classes 25, 26, *and* 27—The Silver Medal.

Andrew Logan, Overton, Coylton.

CLASS 25. BULL, calved before 1899.—Premiums, £12, £8, and £4.—*No Entry.*

CLASS 26. BULL, calved in 1899.—Premiums, £12, £8, and £4.

1. James Howie, Hillhouse, Kilmarnock, "Not Likely" (4469).

CLASS 27. BULL, calved in 1900.—Premiums, £8, £5, and £3.

1. G. J. Fergusson-Buchanan of Auchentorlie, Bowling, "The M'Kinlay."
2. Robert Wardrop, Garlaff, Cumnock, "Princedom."

CLASS 28. COW, calved before 1898, in Milk.—Premiums, £10, £7, and £3.—*Entries transferred to Class* 30.

CLASS 29. COW in Milk, calved after 1st January 1898.—Premiums, £10, £7, and £3.

1. Hugh Duncan, Langalchorad, Rothesay, "Perfection."
2. James M'Alister, Meikle Kilmory, Rothesay, "Beauty."
3. John M'Kay, Barone Park, Rothesay, "Esther."

CLASS 30. COW of any age, in Calf, or HEIFER calved in 1898, in Calf and due to calve within nine months after the Show.—Premiums, £10, £7, and £3.

1. William Howie, Burnhouses, Galston, "White Rose" (12,052).
2. Alexander Cross of Knockdon, Maybole, "Judy III." (11,149).
3. William Holmes, Harelaw, Bridge of Weir, "Lady Norah."
V. James Howie, Hillhouse, Kilmarnock, "Flash Girl" (14,349).

CLASS 31. HEIFER, calved in 1899.—Premiums, £10, £5, and £3.

1. James Howie, Hillhouse, Kilmarnock, "Cinderella."
2. Robert Wardrop, Garlaff, Cumnock, "Sybil."
3. James Howie, Hillhouse, Kilmarnock, "Queen Jessie."

CLASS 32. HEIFER, calved in 1900.—Premiums, £8, £5, and £3.

1. Robert Wardrop, Garlaff, Cumnock, "Vesta Tillie."
2. James Howie, Hillhouse, Kilmarnock, "Alieen Aroon."

FAT CATTLE.

PRESIDENT'S CHAMPION MEDAL for best Fat Animal.

John Ross, Meikle Tarrel, Fearn (Shorthorn), "Gertrude II."

CLASS 33. OX, any pure-bred or cross, calved after 1st December 1898.—Premiums, £5 and £2.

1. J. Douglas Fletcher of Rosehaugh, Avoch (Shorthorn), "The Rajah."
2. J. Douglas Fletcher of Rosehaugh, Avoch (Aberdeen-Angus and Shorthorn), "Sinbad."
V. Sir John Gilmour, Bart. of Lundin and Montrave, Leven (Shorthorn and Highland).
H. D. C. Bruce, Byres Farm, Fochabers (Aberdeen-Angus), "Ben Aigen."
C. R. S. Fraser, Bunchrew House, Bunchrew, Inverness (Cross).

CLASS 34. OX, any pure-bred or cross, calved after 1st December 1899.—Premiums, £5 and £2.

1. George Bruce, Tochineal, Cullen (Aberdeen-Angus).
2. John Ross, Meikle Tarrel, Fearn (Cross).
V. John Ross, Meikle Tarrel, Fearn (Cross).
H. J. Douglas Fletcher of Rosehaugh, Avoch (Aberdeen-Angus and Shorthorn), "Sunray."
C. T. A. Anderson, Ballachraggan, Alness (Cross), "Champion."
C. J. Douglas Fletcher of Rosehaugh, Avoch (Shorthorn and Aberdeen-Angus), "Walter."

CLASS 35. HEIFER, any pure-bred or cross, calved after 1st December 1898.—Premiums, £5 and £2.

1. John Ross, Meikle Tarrel, Fearn (Shorthorn), "Gertrude II."
2. George J. Young, Cadboll, Fearn (Cross).
V. J. Douglas Fletcher of Rosehaugh, Avoch (Aberdeen-Angus), "Erica Countess."

H. George Bruce, Tochineal, Cullen.
C. George Longmore, Rettie, Banff (Cross), "Boyne Leaf."

CLASS 36. HEIFER, any pure-bred or cross, calved after 1st December 1899.—Premiums, £5 and £2.

1. George Inglis of Newmore, Invergordon (Cross).
2. John Ross, Meikle Tarrel, Fearn (Shorthorn), "Sheoctie 4th."
V. J. Douglas Fletcher of Rosehaugh, Avoch (Aberdeen-Angus and Hereford), "Fairy."
H. John Ross, Meikle Tarrel, Fearn (Shorthorn), "Max's Ella."

HORSES

FOR AGRICULTURAL PURPOSES.

DRAUGHT STALLIONS.

PRESIDENT'S CHAMPION MEDAL for best Clydesdale Stallion.

A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.

Breeder of best Male Animal of any age in Classes 37 *to* 40—The Silver Medal.

W. M. Wood, Purston Hall, Pontefract.

CLASS 37. STALLION, foaled before 1898.—Premiums, £20, £15, £10, and £4.

1. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Moncreiffe Marquis" (9953).
2. James Kilpatrick, Craigie Mains, Kilmarnock, "Royal Carrick" (10,270).
3. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Acme" (10,485).
4. William Renwick, Meadowfield, Corstorphine, "Gartly Squire" (10,350).
V. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Eleator" (10,340).
H. Peter Crawford, Dargavel, Dumfries, "Carabineer" (10,522).
C. Matthew Marshall, Stranraer, "Mercutio."

CLASS 38. ENTIRE COLT, foaled in 1898.—Premiums, £20, £15, £10, and £4.

1. William Clark, Netherlea, Cathcart, "Pride of Blacon" (10,827).
2. Herbert Webster, Morton House, Fence Houses, "Baron's Crown" (10,679).
3. The Northern Stud Company, Burgie Lodge Farm, Forres, "Pearl Oyster" (10,831).
4. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Concord" (10,720).
V. George A. Ferguson, Surradale, Elgin, "Sir Claude" (10,914).

CLASS 39. ENTIRE COLT, foaled in 1899.—Premiums, £20, £12, £8, and £4.

1. Seaham Harbour Stud Co., Ltd., Seaham Harbour, "Silver Cup" (11,184).
2. William Park, Brunstane, Portobello, "Marmion."
3. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Baron's Chief" (10,971).
4. St. Clair Cunningham, Hedderwick Hill, Dunbar, "Alexander Everard."
V. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Baron's Gem (10,974).
H. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
C. Richard Dunn, [illegible]on, Hamilton, "City of Riches" (11,012).

CLASS 40. ENTIRE COLT, foaled in 1900.—Premiums, £15, £10, £6, and £4.

1. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Everlasting."
2. W. S. Park, Hatton, Bishopton, "Ardlethen."
3. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
4. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
V. Seaham Harbour Stud, Ltd., Seaham Harbour.
H. George A. Ferguson, Surradale, Elgin, "Sir Peter."
C. John M'Nee, Afton House, Crieff, "Baron Afton."

DRAUGHT GELDINGS.

PRESIDENT'S CHAMPION MEDAL for best Draught Gelding.

William Clark, Netherlea, Cathcart, "Perfection."

CLASS 41. DRAUGHT GELDING, foaled before 1898.— Premiums, £10, £5, and £3.

1. William Clark, Netherlea, Cathcart, "Perfection."
2. George Williamson, Knocknageal, Inverness, "Punch."
3. George Williamson, Knocknageal, Inverness, "Jock."

V. James Strother, Balmachree, Inverness.

CLASS 42. DRAUGHT GELDING, foaled in 1898.—Premiums, £6, £4, and £3.

1. William Clark, Wester Bogie, Kirkcaldy.
2. William Clark, Netherlea, Cathcart, "Excelsior."
3. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Justice."

V. Charles J. Ness, Calrossie Mains, Nigg Station, "Prince."

CLASS 43. DRAUGHT GELDING, foaled in 1899.—Premiums, £6, £4, and £3.

1. William Clark, Netherlea, Cathcart, "Tom."

DRAUGHT MARES AND FILLIES.

PRESIDENT'S CHAMPION MEDAL for best Clydesdale Mare or Filly.

Herbert Webster, Morton House, Fence Houses, "Lady Lothian" (13,319).

Best Mare or Filly registered in the Clydesdale Stud-Book—Cawdor Challenge Cup, value 50 guineas, given by the Clydesdale Horse Society.

Herbert Webster, Morton House, Fence Houses, "Lady Lothian" (13,319).

• *Breeder of Best Clydesdale Brood Mare*—The Robert Murdoch Prize, value £10.

The late W. H. Lumsden of Balmedie, Aberdeen.

CLASS 44. MARE, of any age, with Foal at foot.— Premiums, £20, £12, £7, and £4.

1. Sir John Gilmour of Montrave, Bart., Leven, Fife, "Balmedie Queen Mab" (13,513).
2. G. & J. Cocker, Hill of Petty, Fyvie, "Lady Douglas."
3. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Princess Beautiful."
4. The Earl Cawdor, Cawdor Castle, Nairn, "Nellie Grey."

C. J. Ernest Kerr, Harviestoun, Dollar, "Lady Garnet."

CLASS 45. YELD MARE, foaled before 1898.—Premiums, £12, £9, £6, and £4.

1. Alexander Guild, W.S., Aberlady Mains, Aberlady, "Lady Margaret" (13,833).
2. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Princess of Glasnick."
3. St Clair Cunningham, Hedderwick Hill, Dunbar, "Maggie Holmes."
4. Leslie Durno, Mains of Glack, Pitcaple, "Gwendoline" (14,202).

H. Sir John Gilmour of Montrave, Bart., Leven, Fife, "Lady Victoria."
C. Ralph Holmes, Whitburn Moors, Sunderland, "Lady Raffan" (13,933).

CLASS 46. YELD MARE or FILLY, foaled in 1898.— Premiums, £12, £9, £6, and £4.

1. Alexander Guild, W.S., Aberlady Mains, Aberlady, "Topsy Pride."
2. Thomas Smith, Blacon Point, Chester, "Cedric Princess."
3. William Taylor, Park Mains, Renfrew, "Legacy."
4. William M'Keich, Woodend, Buchlyvie, "Music."

C. Thomas Smith, Blacon Point, Chester, "Baron's Beauty."

CLASS 47. FILLY, foaled in 1899.—Premiums, £12, £9, £6, and £4.

1. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Pomona."
2. Herbert Webster, Morton House, Fence Houses, "Lady Rose."
3. St Clair Cunningham, Hedderwick Hill, Dunbar, "White Heather."
4. William Taylor, Park Mains, Renfrew, "Rose."
V. Richard Dunn, Udston, Hamilton, "Flash Flossie."
H. Herbert Webster, Morton House, Fence Houses, "Lady Brenda."
C. William M'Keich, Woodend, Buchlyvie, "Lady Ross."

CLASS 48. FILLY, foaled in 1900.—Premiums, £12, £9, £6, and £4.

1. Thomas Smith, Blacon Point, Chester, "Royal Ruby."
2. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Pyrene."
3. Herbert Webster, Morton House, Fence Houses, "Lady Sibyl."
4. David Mitchell of Millfield, Polmont, "Princess Roberta."
H. Thomas Smith, Blacon Point, Chester, "Jenny Lind."
C. G. & J. Cocker, Hill of Petty, Fyvie, "Lady Thomas."

EXTRA STOCK.

The following was Highly Commended, and a Medium Silver Medal awarded.

George Inglis of Newmore, Invergordon, Stallion, one-fourth Arab, three-fourths thoroughbred, "Lionel."

HUNTERS.

PRESIDENT'S CHAMPION MEDAL for best Hunter.

David Stevenson, Crossburn, Troon, Gelding, "Crossburn."

Best Hunter Filly in Classes 49, 50, *and* 51—Gold Medal, value £10, 10s., given by the Hunter Improvement Society.

Captain Clayhills Henderson of Invergowrie, R.N., Dundee, Mare, "La Diabless."

Best Colt or Gelding in Classes 49, 50, *and* 51—£10, given by Mr C. D. Stewart of Brin.

David Stevenson, Crossburn, Troon, Gelding, "Crossburn."

CLASS 49. COLT, GELDING, or FILLY, foaled in 1900, the produce of thoroughbred Stallions, out of Mares of any breed.—Five Prizes—£10, £7, £5, £2, and £1, given by Sir John Gilmour of Montrave, Bart.

1. J. A. Campbell, Craigie House, Ayr, Colt, "Ballyhaugh."
2. Sir Reginald Ogilvy of Inverquharity, Bart, Baldovan House, Strathmartine, Forfarshire, Filly, "Moselle."
3. Charles J. Ness, Calrossie Mains, Nigg Station. Filly.
4. Charles J. Ness, Calrossie Mains, Nigg Station, Filly.
5. R. Trotter, Garguston, Muir of Ord, Colt, "Ronald."

CLASS 50. FILLY, MARE, or GELDING, for field, foaled in 1899, *in hand.*—Premiums, £8, £5, and £3.

1. J. Arres-Mather, Delnies, Nairn, Gelding, "Lancer."
2. J. Harling Turner, Cessnock, Galston, Gelding, "Cessnock."
3. Captain Clayhills Henderson of Invergowrie, R.N., Dundee, Mare, "La Diabless."
H. John Cairns, Belhie, Auchterarder, Filly, "Lady Peggy."
C. Alexander Howe, Parks of Inshes, Inverness, Gelding, "Marquise."

CLASS 51. YELD MARE, FILLY, or GELDING, for field, foaled in 1898, *in hand.*—Premiums, £8, £5, and £3.

1. David Stevenson, Crossburn, Troon, Gelding, "Crossburn."
2. Charles H. Beveridge, Crombie, Dunfermline, Filly, "Sybil."
3. J. Arres-Mather, Delnies, Nairn, Gelding, "Victor."
H. George Inglis of Newmore, Invergordon, Gelding.
C. J. Arres-Mather, Delnies, Nairn, Filly, "Kathleen."

CLASS 52. HUNTER BROOD MARE, with Foal at Foot or to foal this season.—Premiums, £15, £8, and £4, given by Captain Clayhills Henderson of Invergowrie, R.N.

1. Captain Clayhills Henderson of Invergowrie, R.N., Dundee, "Rosemary."
2. George Russell, Hatton, Lundin Links, "Meta."
3. J. A. Campbell, Craigie House, Ayr, "Gloriana."
V. Sir Reginald Ogilvy of Inverquharity, Bart., Baldovan House, Strathmartine, Forfarshire, "Daisy."
H. J. Arres-Mather, Delnies, Nairn, "Trilby."
C. J. C. Martin, Netherwood, Dumfries, "Queenie."

HACKNEYS.

(ALL TO BE SHOWN IN HAND.)

PRESIDENT'S CHAMPION MEDAL for best Hackney.

Alfred A. Haley, Stud Farm, Eddlethorpe, Malton, "Welwick Bright Merry" (13,175).

Best Mare or Filly in Hackney or Pony Classes—Gold Medal, value £10, given by the Hackney Horse Society.

Alfred A. Haley, Stud Farm, Eddlethorpe, Malton, "Welwick Bright Merry" (13,175).

CLASS 53. BROOD MARE, 15 hands and upwards, with Foal at Foot or to foal this season to a registered sire. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Alfred A. Haley, Stud Farm, Eddlethorpe, Malton, "Welwick Bright Merry" (13,175).
2. Mrs Mackenzie Fraser, Castle Fraser, Kenmay, "Lady Madison" (6922).
3. James Prentice, Carolside, Uddingston, "Pretty Jane" (821).

CLASS 54. BROOD MARE, under 15 hands, with Foal at Foot or to foal this season to a registered sire. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Andrew Wilson, Northmains, Stepps, "Twilight" (4819).
2. Mrs Mackenzie Fraser, Castle Fraser, Kenmay, "Lady Alice" (1170).

CLASS 55. YELD MARE or FILLY, foaled in 1898. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.—*No Entry.*

CLASS 56. FILLY, foaled in 1899. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. Lord Tweedmouth, Guisachan, Beauly, "Marvel."
2. Lord Tweedmouth, Guisachan, Beauly, "Mystery."

CLASS 57. FILLY, foaled in 1900, eligible for entry in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. Robert Watkinson, Balloch Hotel, Balloch, "Lady Coe."
2. James Prentice, Carolside, Uddingston, "Bothwell Star."

CLASS 58. STALLION, foaled in or before 1898, over 15 hands. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Alfred A. Haley, Stud Farm, Eddlethorpe, Malton, "Merry Pioneer" (7[illegible]
2. Edward Ostlere, Chapel House, Kirkcaldy, "Sportsman III." (6908).
3. R. D. Cameron, Lochgorm, Inverness, "Baron IV." (5501).

CLASS 59. STALLION, foaled in or before 1898, over 14 and not over 15 hands. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Lord Tweedmouth, Guisachan, Beauly, N.B. "Miracle."

CLASS 60. ENTIRE COLT, foaled in 1899. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. Mrs Mackenzie Fraser, Castle Fraser, Kenmay, "Connaught Boy" (7407).
2. J. Douglas Fletcher of Rosehaugh, Avoch, "Rosehaugh Goldsmith" (7587).

CLASS 61. ENTIRE COLT, foaled in 1900, eligible for entry in Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. Charles B. Ovenstone, Cairnbank, Brechin, "Scotch Rosador."

PONIES.

PRESIDENT'S CHAMPION MEDAL for best Pony.

Alexander Morton, Gowanbank, Darvel, Mare, "Fiona" (10,918).

CLASS 62. STALLION, 3 years old and upwards, over 12, not exceeding 14 hands, *in hand.*—Premiums, £5, £3, and £2.

1. R. W. R. Mackenzie, Stormontfield, Perth, "Bloonfield."
2. Andrew Wilson, Northmains, Stepps, "Carleton Wonder" (7369).
3. D. Stewart Mackintosh, Gair Katta, Western Dooars, Jalpaiguri, *viâ* Calcutta, India, "Babel," late "Aristocrat."

CLASS 63. YELD MARE, FILLY, or GELDING, 3 years old and upwards, over 13 and not over 14½ hands, *in saddle.*—Premiums, £5, £3, and £2.

1. Alexander Morton, Gowanbank, Darvel, Mare, "Fiona" (10,918).
2. Mrs George Younger, 4 Douglas Gardens, Edinburgh, Mare, "Blossom."
3. John A. Robertson, Royal Stables, Nairn, Mare, "Kaki."

CLASS 64. YELD MARE, FILLY, or GELDING, 3 years old and upwards, over 12 and not over 13 hands, *in saddle.*—Premiums, £5, £3, and £2.

1. Alexander Leslie of Braco, Keith, Gelding, "Llewellyn."

CLASS 65. STALLION, 3 years old and upwards, 12 hands and under, *in hand.*—Premiums, £5, £3, and £2.—*No Entry.*

CLASS 66. YELD MARE, FILLY, or GELDING, 3 years old and upwards, 12 hands and under, *in saddle.*—Premiums, £5, £3, and £2.—*No Entry.*

EXTRA STOCK.

The following was Very Highly Commended, and a Medium Silver Medal awarded.

John Stirling of Fairburn, Muir of Ord, Pony Mare.

HIGHLAND PONIES.

CLASS 67. PONY STALLION, not exceeding 14.2 hands, best adapted to get ponies, out of Highland Pony Mares, suitable for Mounted Infantry.—Prize of £20, given by Lord Tweedmouth.

1. Lord Tweedmouth, Guisachan, Beauly, N.B., "Miracle."
V. William Dalziel Mackenzie of Farr, Daviot, Inverness, "Johnnie."
H. Donald M'D. Mackintosh, Platchaig, Beauly, "FitzGeorge."

CLASS 68. HIGHLAND-BRED PONY, any age, YELD MARE or GELDING, not exceeding 14.2 hands, suitable for Mounted Infantry.—First Prize, £12; Second Prize, £5; Third Prize, £3—given by Lord Tweedmouth.

1. J. H. Munro Mackenzie, Calgary, Isle of Mull, Mare, "Langamull."
2. Lord Tweedmouth, Guisachan, Beauly, "Marvel."
3. Lord Tweedmouth, Guisachan, Beauly, "Mystery."
H. J. H. Munro Mackenzie, Calgary, Isle of Mull, Gelding, "Mountain Boy."
C. Wm. Dalziel Mackenzie of Farr, Daviot, Inverness, Mare, "Skye."

EXTRA STOCK.

The following was Highly Commended, and a Medium Silver Medal awarded.

William Dalziel Mackenzie of Farr, Daviot, Inverness, Mare, "Browlen."

The following was Commended, and a Bronze Medal awarded.

G. Bullough, Kinloch Castle, Rum, Mare and foal.

SHETLAND PONIES.

(ALL TO BE SHOWN IN HAND.)

PRESIDENT'S CHAMPION MEDAL for best Shetland Pony.

Mrs Wentworth Hope Johnstone, Skeynes, Edenbridge, Kent, "Skylark."

Best four-in-hand team of Shetland Ponies, to be driven in the ring—Silver Cup, value £10, 10s., given by Mr Fletcher of Rosehaugh.

Mrs Wentworth Hope Johnstone, Skeynes, Edenbridge.

CLASS 69. STALLION, not exceeding 10½ hands, foaled before 1898.—Premiums, £5, £3, and £2.

1. Charles Douglas, M.P., Auchlochan, Lesmahagow, "Frederick."
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Sultan."
3. Walter Aitchison, Coniecleugh, Huntly, "Muness" (124).
V. George A. Miller, Knowehead, Perth, "Palmer."
H. Seaham Harbour Stud Co., Ltd., Seaham Harbour, "Tempest"

CLASS 70. ENTIRE COLT, not exceeding 10½ hands, foaled in 1898 or 1899.—Premiums, £5, £3, and £2.

1. R. W. R. Mackenzie, Earlshall, Leuchars, "Ramoth."
2. J. Douglas Fletcher of Rosehaugh, Avoch, "Merry Hero."
3. John Cran, Kirkton, Bunchrew, "Silver King."

CLASS 71. MARE, not exceeding 10½ hands, with Foal at foot.—Premiums, £5, £3, and £2.

1. R. W. R. Mackenzie, Earlshall, Leuchars, "Pansy" (1282).
2. Lady Waldie-Griffith, Hendersyde Park, Kelso, "Virtuous."
3. George A. Miller, Knowehead, Perth, "Harriet" (1194).
V. J. Douglas Fletcher of Rosehaugh, Avoch, "Runa" (1092).
H. John M'Donald, Keppoch, Roy Bridge, "Thistle" (1115).
C. John Cran, Kirkton, Bunchrew, "Gold Mine."

CLASS 72. YELD MARE, not exceeding 10½ hands.—Premiums, £5, £3, and £2.

1. Mrs Wentworth Hope Johnstone, Skeynes, Edenbridge, Kent, "Sapphire" (1276).
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Bracelet."
3. Mrs Wentworth Hope Johnstone, Skeynes, Edenbridge, Kent, "Topaz" (1116).
V. Charles Douglas, M.P., Auchlochan, Lesmahagow, "Belinda."
H. W. G. Dick, of Macrae & Dick, Inverness, "Lucky."
C. Mrs Wentworth Hope Johnstone, Skeynes, Edenbridge, Kent, "Vesta."

CLASS 73. FILLY, not exceeding 10½ hands, foaled in 1898 or 1899.—Premiums, £5, £3, and £2.

1. Walter Aitchison, Coniecleugh, Huntly, "Strawberry."
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Harebell."
3. John Cran, Kirkton, Bunchrew, "Geisha."
V. George A. Miller, Knowehead, Perth, "Madame."

DRIVING COMPETITIONS.

PRESIDENT'S CHAMPION MEDAL for best animal in the Classes for Horses in Harness.

James Prentice, Carolside, Uddingston, Gelding, "Bothwell Squire."

CLASS 74. YELD MARE, FILLY, or GELDING, in Harness, 15 hands and upwards, to be driven in the ring.—Premiums, £10, £5, and £3.

1. James Prentice, Carolside, Uddingston, Gelding, "Bothwell Squire."
2. Alexander Howe, Parks of Inshes, Inverness, Gelding, "Duke."
3. Macrae & Dick, Job and Postmasters, Inverness, Gelding, "Autocrat."

H. Macrae & Dick, Job and Postmasters, Inverness, Gelding, "Conqueror."
C. William Logan, M.R.C.V.S., 3 Victoria Circus, Inverness, Gelding, "Bide-a-wee."

CLASS 75. YELD MARE, FILLY, or GELDING, in Harness, under 15 hands, to be driven in the ring.—Premiums, £10, £5, and £3.

1. Alexander Morton, Gowanbank, Darvel, Mare, "Fiona" (10,918).

JUMPING COMPETITIONS

Wednesday, 17th July.

CLASS 1. HORSES, Open.—Premiums, £20, £10, and £5.

1. F. V. Grange, Farndon, Chester, Gelding, "Hardcash."
2. James Nodwell, New George Hotel, Dumfries, Gelding, "High Life."
3. J. Wheeler, Shakespeare Farm, Studley, Mare, "Confidence."

CLASS 2. PONIES, 14.3 hands and under.—Premiums, £10, £5, and £3.

1. James Nodwell, New George Hotel, Dumfries, Mare, "Moderation."
2. J. Wheeler, Shakespeare Farm, Studley, Gelding, "Laddie."
3. William Riddick, Crookdyke Hall, Mealsgate, Mare, "Darkie."

Thursday, 18th July.

CLASS 3. HORSES, Open Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in Class 1.—Premiums, £10, £6, and £3.

1. F. V. Grange, Farndon, Chester, Gelding, "Hardcash."
2. D. Carnegie, East Pitcorthie, Colinsburgh, Gelding, "Blackie."
3. W. Johnstone, St Andrews, Gelding, "King John."

CLASS 4. PONIES, 14.3 hands or under, Handicap, hurdles and gate being raised 4 inches for first prize winner in Class 2.—Premiums, £5, £3, and £1.

1. J. Wheeler, Shakespeare Farm, Studley, Gelding, "Laddie."
2. William Riddick, Crookdyke Hall, Mealsgate, Mare, "Darkie."
3. D. Carnegie, East Pitcorthie, Colinsburgh, Gelding, "Baylark."

Friday, 19th July.

CLASS 5. HORSES, Open Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in either of Classes 1 or 3—4 inches extra for the winner of the two first prizes in Classes 1 and 3.—Premiums, £10, £6, and £3.

1. F. V. Grange, Farndon, Chester, Gelding, "Hardcash."
2. J. Wheeler, Shakespeare Farm, Studley, Mare, "Confidence."
3. W. Johnstone, St Andrews, Gelding, "King John."

CLASS 6. PONIES, 14.3 hands or under, Handicap, hurdles and gate being raised 4 inches for the winner of the first prize in Classes 2 or 4, and 8 inches for winner of the first prize in both these Classes.—Premiums, £5, £3, and £1.

1. William Riddick, Crookdyke Hall, Mealsgate, Mare, "Darkie."
2. J. Wheeler, Shakespeare Farm, Studley, Gelding, "Laddie."
3. D. Carnegie, East Pitcorthie. Colinsburgh, Gelding, "Baylark."

Champion Prize of £10 for most points in Prizes with one or more Horses in above Classes—First Prize to count three points; Second Prize, two points; and Third Prize, one point. The money to be evenly divided in the event of a tie.

J. Wheeler, Shakespeare Farm, Studley.

Thursday Evening at 7 P.M.

CLASS 1. HORSES, Open.—Premiums, £7, £5, and £3.

1. F. V. Grange, Farndon, Chester, Gelding, "Hardcash."
2. James Nodwell, New George Hotel, Dumfries, Gelding, "High Life."
3. W. Johnstone, St Andrews, Gelding, "King John."

CLASS 2. PONIES, 14.3 hands and under.—Premiums, £3 and £2.

1. William Riddick, Crookdyke Hall, Mealsgate, Mare, "Darkie."
2. J. Wheeler, Shakespeare Farm, Studley, Gelding, "Laddie."

SHEEP

BLACKFACED.

PRESIDENT'S CHAMPION MEDAL for best Pen of Blackfaced Sheep

J. Archibald, Overshiels, Stow.

CLASS 76. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. J. Archibald, Overshiels, Stow.
2. Charles Howatson of Glenbuck.
3. John Craig, Innergeldie, Comrie.
4. J. Archibald, Overshiels, Stow.
V. Charles Howatson of Glenbuck.
H. James Duncan Balfour, Brechin.
C. J. Archibald, Overshiels, Stow.

CLASS 77. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. Charles Howatson of Glenbuck.
2. Charles Howatson of Glenbuck.
3. Charles Howatson of Glenbuck.
4. Charles Howatson of Glenbuck.
V. James Duncan Balfour, Brechin.
H. R. C. Munro-Ferguson of Novar, M.P., Evanton.
C. James Duncan Balfour, Brechin.

CLASS 78. EWE, above one Shear, with her Lamb at foot.—Premiums, £10, £5, and £2.

1. D. T. Martin, Dunlossit, Port Askaig, Isle of Islay.
2. John Craig, Innergeldie, Comrie.
3. D. T. Martin, Dunlossit, Port Askaig, Isle of Islay.
V. John Craig, Innergeldie, Comrie.
H. James A. Gordon, Arabella, Nigg Station (BY 16).
C. John Craig, Innergeldie, Comrie.

CLASS 79. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. James A. Gordon, Arabella, Nigg Station.
2. James A. Gordon, Arabella, Nigg Station.
3. John Ross, Meikle Tarrel, Fearn.
V. John Craig, Innergeldie, Comrie.

CHEVIOT.

PRESIDENT'S CHAMPION MEDAL for best Pen of Cheviot Sheep.

John Elliot, Hindhope, Jedburgh, "Professor Plumb."

CLASS 80. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. John Elliot, Hindhope, Jedburgh, "Professor Plumb."
2. John Elliot, Hindhope, Jedburgh, "Lochiel."
3. John Elliot, Hindhope, Jedburgh, "Joseph Adie."
4. Matt. S. M'Kerrow, Boreland of Southwick, Dumfries.
V. Murdo Macleod, Woodend, Drummond, Inverness.

CLASS 81. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. John Elliot, Hindhope, Jedburgh.
3. John Elliot, Hindhope, Jedburgh.
4. Matt. S. M'Kerrow, Boreland of Southwick, Dumfries.

CLASS 82. EWE, above one Shear, with her Lamb at foot.—Premiums, £10, £5, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. John Elliot, Hindhope, Jedburgh.
3. John Elliot, Hindhope, Jedburgh.
V. Matt. S. M'Kerrow, Boreland of Southwick, Dumfries.
H. Matt. S. M'Kerrow, Boreland of Southwick, Dumfries.

CLASS 83. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. John Elliot, Hindhope, Jedburgh.
3. W. & C. Mundell, Dalchork, Lairg.
V. John Elliot, Hindhope, Jedburgh.
H. Matt. S. M'Kerrow, Boreland of Southwick, Dumfries.

BORDER LEICESTER.

PRESIDENT'S CHAMPION MEDAL for best Pen of Border Leicesters.

David Hume, Barrelwell, Brechin.

CLASS 84. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. T. M'Intosh, Balquharn, Brechin, "The M'Intosh" (557).
2. Robert Taylor, Pitlivie Farm, Carnoustie, "Pitlivie Earl" (495).
3. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.
4. Matthew Templeton, Sandyknowe, Kelso.
H. Matthew Templeton, Sandyknowe, Kelso.
C. W. A. Cumming, Allanfearn, Inverness, "Clark Allan" (421).

CLASS 85. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. David Hume, Barrelwell, Brechin.
2. David Hume, Barrelwell, Brechin.
3. J. & J. R. C. Smith, Galalaw, Kelso.
4. Robert Wallace, Auchenbrain, Mauchline.
V. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.

H. J. & J. R. C. Smith, Galalaw, Kelso.
C. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.
C. Robert Wallace, Auchenbrain, Mauchline.

CLASS 86. EWE, above one Shear.—Premiums, £10, £5, and £2.

1. T. M'Intosh, Balquharn, Brechin.
2. J. & J. R. C. Smith, Galalaw, Kelso.
3. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.
V. Matthew Templeton, Sandyknowe, Kelso.
H. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.

CLASS 87. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. David Hume, Barrelwell, Brechin.
2. David Hume, Barrelwell, Brechin.
3. J. & J. R. C. Smith, Galalaw, Kelso.
V. George Willsher, Pitpointie, Dundee.
H. J. & J. R. C. Smith, Galalaw, Kelso.
C. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.

HALF-BRED.

PRESIDENT'S CHAMPION MEDAL for best Pen of Half-Breds.

Andrew T. Elliot, Newhall, Galashiels.

Best Half-Bred Tup in Classes 88 *and* 89—£5, given by Breeders, per Mr John Bertram.

Andrew T. Elliot, Newhall, Galashiels.

Best Half-Bred Ewe or Gimmer in Classes 90 *and* 91—£5, given by Breeders, per Mr John Bertram.

James A. W. Mein, Hunthill, Jedburgh.

CLASS 88. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. James A. W. Mein, Hunthill, Jedburgh.
2. James A. W. Mein, Hunthill, Jedburgh.
3. L. Morley Crossman, Cheswick House, Beal, R.S.O., Northumberland.
4. Alexander Crosbie, Blegbie, Upper Keith.

CLASS 89. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. Andrew T. Elliot, Newhall, Galashiels.
2. Andrew T. Elliot, Newhall, Galashiels.
3. Andrew T. Elliot, Newhall, Galashiels.
4. John Bertram, Addinston, Lauder.
H. John Bertram, Addinston, Lauder.
C. Robert Dickinson, Longcroft, Lauder.

CLASS 90. EWE, above one Shear.—Premiums, £10, £5, and £2.

1. James A. W. Mein, Hunthill, Jedburgh.
2. Robert Dickinson, Longcroft, Lauder.
3. James A. W. Mein, Hunthill, Jedburgh.
H. James A. W. Mein, Hunthill, Jedburgh.
C. Alexander Crosbie, Blegbie, Upper Keith.

CLASS 91. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. James A. W. Mein, Hunthill, Jedburgh.
2. L. Morley Crossman, Cheswick House, Beal, R.S.O., Northumberland.
3. James A. W. Mein, Hunthill, Jedburgh.
H. James A. W. Mein, Hunthill, Jedburgh.
C. John Ross, Meikle Tarrel Fearn.

SHROPSHIRE.

PRESIDENT'S CHAMPION MEDAL for best Pen of Shropshires.

The Earl of Strathmore, Glamis Castle, Forfar.

CLASS 92. TUP, above one Shear.—Premiums, £6, £4, and £2.

1. George Inglis, Newmore, Invergordon.

CLASS 93. SHEARLING TUP.—Premiums, £6, £4, and £2.

1. The Earl of Strathmore, Glamis Castle, Forfar.
2. The Earl of Strathmore, Glamis Castle, Forfar.
3. The Earl of Strathmore, Glamis Castle, Forfar.
V. William Mortimer, Old Keig, Whitehouse, Aberdeen.
C. George Inglis, Newmore, Invergordon.

CLASS 94. EWE, above one Shear.—Premiums, £5, £3, and £2.

1. The Earl of Strathmore, Glamis Castle, Forfar.
2. The Earl of Strathmore, Glamis Castle, Forfar.
3. George Inglis, Newmore, Invergordon.

CLASS 95. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2.

1. The Earl of Strathmore, Glamis Castle, Forfar.
2. The Earl of Strathmore, Glamis Castle, Forfar.
3. The Earl of Strathmore, Glamis Castle, Forfar.
C. George Inglis, Newmore, Invergordon.

OXFORD DOWNS.

PRESIDENT'S CHAMPION MEDAL for best Pen of Oxford Downs.

Walter Elliot, Hollybush, Galashiels.

CLASS 96. SHEARLING TUP.—Premiums, £6, £4, and £2.

1. Walter Elliot, Hollybush, Galashiels.
2. Walter Elliot, Hollybush, Galashiels.
3. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.

CLASS 97. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2.

1. Walter Elliot, Hollybush, Galashiels.
2. Walter Elliot, Hollybush, Galashiels.
3. The Right Hon. A. J. Balfour, M.P., Whittingehame, Prestonkirk.

EXTRA STOCK.

The following was Commended, and a Bronze Medal awarded.

James M. Howe, Castle Heather, Inverness (Tup).

SUFFOLK.

PRESIDENT'S CHAMPION MEDAL for best Pen of Suffolk Sheep.

Major E. W. Baird, Exning House, Newmarket.

CLASS 98. SHEARLING TUP.—Premiums, £6, £4, and £2.

1. Major E. W. Baird, Exning House, Newmarket.

CLASS 99. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2.

1. Major E. W. Baird, Exning House, Newmarket.
2. William Ford, Fentonbarns, Drem.
3 William Ford, Fentonbarns, Drem.

CLASS 100. THREE EWE LAMBS.—Premiums, £5, £3, and £2, given by the Suffolk Sheep Society.

1. Major E. W. Baird, Exning House, Newmarket.

EXTRA SECTIONS.

Best Pen of Lambs in Class 101 *got by a Suffolk Tup, and out of Cheviot or Black-faced Ewes*—Prize of £5, given by the Suffolk Sheep Society.—*No Entry.*

Best Pen of Lambs in Class 101 *got by a Suffolk Tup, and out of Border Leicester, Half-bred, or Three-parts-bred Ewes*—Prize of £5, given by the Suffolk Sheep Society.—*No Entry.*

Best Pens of Cross-bred Lambs in Class 101 *got by an Oxford-Down Tup*—Prizes of £6, £4, and £3, given by Oxford-Down Sheep Breeders' Association.

1. Major E. W. Baird, Exning House, Newmarket (Oxford-Down Tup out of Hampshire Ewes).
2. R. Macfarlane, Tomich, Invergordon (Oxford Tup out of Half-bred Ewes).
3. John Ross, Meikle Tarrel, Fearn (Oxford-Down Tup out of Half-bred Ewes).

Best Pens of Cross-bred Lambs in Class 101 *got by a Shropshire Tup*—Prizes of £5, 5s., £3, 3s., and £2, 2s., given by Breeders of Shropshire Sheep, per Mr David Buttar.

1. George Willsher, Pitpointie, Dundee (Shropshire Tup out of Border Leicester Ewes).

CLASS 101. Five FAT LAMBS, any Breed or Cross, dropped after 1st January of the year of the Show.—Premiums, £5 and £3.

1. George Willsher, Pitpointie, Dundee (Shropshire Tup out of Border Leicester Ewes).
2. Major E. W. Baird, Exning House, Newmarket (Oxford-Down Tup out of Hampshire Ewes).

V. R. Macfarlane, Tomich, Invergordon (Oxford Tup out of Half-bred Ewes).
H. John Ross, Meikle Tarrel, Fearn (Oxford-Down Tup out of Half-bred Ewes).

EXTRA STOCK.

The following was Very Highly Commended, and a Medium Silver Medal awarded.

Sir John Gilmour, Bart. of Lundin and Montrave, Leven (three Blackfaced Shearling Wethers).

The following was Highly Commended, and a Medium Silver Medal awarded.

Sir John Gilmour, Bart. of Lundin and Montrave, Leven (three Blackfaced Shearling Wethers).

The following was Commended, and a Bronze Medal awarded.

Lady Anne Murray of Lochcarron, Courthill House, Lochcarron (group of St Kilda Sheep and Lambs).

WOOL

BLACKFACE WOOL.

CLASS 102. BLACKFACE WETHER WOOL, five Fleeces.—Premiums, £3, £2, and £1, given by Sir Robert Menzies, Bart.

1. James S. Reid, Penchrise, Hawick.
2. C. & D. Willison, Acharn, Killin.
3. George Bullough, Isle of Rum, Oban.

V. C. & D. Willison, Glenlochay, Killin.
H. James S. Reid, Penchrise, Hawick.

CLASS 103. BLACKFACE EWE WOOL, five Fleeces.—Premiums, £3, £2, and £1, given by Sir Robert Menzies, Bart.

1. James Milligan, Hayfield, Thornhill (from Sciberscross, Rogart).
2. James S. Reid, Penchrise, Hawick.
3. James Milligan, Hayfield, Thornhill (from Glenhurich, Strontian).
V. C. & D. Willison, Acharn, Killin.
H. C. & D. Willison, Glenlochay, Killin.

CLASS 104. BLACKFACE EWE or WETHER HOGG WOOL, five Fleeces.—Premiums, £3, £2, and £1, given by Sir Robert Menzies, Bart.

1. C. & D. Willison, Glenlochay, Killin.
2. James Milligan, Hayfield, Thornhill (from Glenhurich, Strontian).
3. George Bullough, Isle of Rum, Oban.
V. James Milligan, Hayfield, Thornhill (from Sciberscross, Rogart).
H. C. & D. Willison, Acharn, Killin.
C. James S. Reid, Penchrise, Hawick.

SWINE

PRESIDENT'S CHAMPION MEDAL for best Pen of Swine.

Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Hugh."

LARGE WHITE BREED.

CLASS 105. BOAR.—Premiums, £5 and £3.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Hugh."
2. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Borrowfield Topsman" (5037).
C. Inverness District Asylum, Inverness, "Holywell Joe."

CLASS 106. SOW.—Premiums, £5 and £3.

1. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Dalmeny Long Lass" (9448).
2. James Tocher, Blairmore, Nairn, "Blairmore Daisy."
C. Inverness District Asylum, Inverness, "Daisy."

CLASS 107. Three PIGS, not above 8 months old.—Premiums, £4 and £2.

1. A. Enever Todd, Stoneybank, Musselburgh.
2. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.

WHITE BREED OTHER THAN LARGE.

CLASS 108. BOAR.—Premiums, £5 and £3.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Count Curly."

CLASS 109. SOW.—Premiums, £5 and £3.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Middlesboro' II."
2. J. Jefferson, Peel Hall, Chester.

CLASS 110. Three PIGS, not above 8 months old.—Premiums, £4 and £2.—*No Entry.*

BERKSHIRE.

CLASS 111. BOAR.—Premiums, £5 and £3.

1. J. Jefferson, Peel Hall, Chester, "Peel King Edward VII."
2. J. Jefferson, Peel Hall, Chester.

CLASS 112. SOW.—Premiums, £5 and £3.

1. J. Jefferson, Peel Hall, Chester, "Peel Marie" (7569).
2. J. Jefferson, Peel Hall, Chester, "Peel Ada" (7338).

CLASS 113. Three PIGS, not above 8 months old.—Premiums, £4 and £2.

1. J. Jefferson, Peel Hall, Chester.
2. J. Jefferson, Peel Hall, Chester.
C. George Inglis, Newmore, Invergordon.

POULTRY

First Premium—*One Sovereign.* Second Premium—*Ten Shillings.* And where there are Six or more entries, Third Premium—*Five Shillings.*

CHAMPION MEDALS.

1. *Best Cock, any variety.*

Robert Fitton, Ribby Hall, Kirkham, Lancashire.

2. *Best Hen, any variety.*

J. T. Cathcart, Dunbog House, Newburgh, Fife.

3. *Best Cockerel, any variety.*

D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Brahma).

4. *Best Pullet, any variety.*

D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Brahma).

5. *Best Pen of Ducks.*

Countess of Home, The Hirsel, Coldstream.

6. *Best Pen of Geese.*

John Page, Hydropathic, Dunblane (Embden).

7. *Best Pen of Turkeys.*

W. A. Cumming, Allanfearn, Inverness (American Bronze).

CLASS 1. DORKING—Coloured. Cock.

1. J. T. Cathcart, Dunbog House, Newburgh, Fife.
2. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr.
3. John Gillies, Edington Mills, Chirnside.

CLASS 2. DORKING—Coloured. Hen.

1. J. T. Cathcart, Dunbog House, Newburgh, Fife.
2. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr.
V. Countess of Home, The Hirsel, Coldstream.

CLASS 3. DORKING—Coloured. Cockerel.

1. J. T. Cathcart, Dunbog House, Newburgh, Fife.
2. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
3. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr.
V. J. T. Cathcart, Dunbog House, Newburgh, Fife.

CLASS 4. DORKING—Coloured. Pullet.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. Countess of Home, The Hirsel, Coldstream.
V. J. T. Cathcart, Dunbog House, Newburgh, Fife.
H. J. T. Cathcart, Dunbog House, Newburgh, Fife.
C. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr.

CLASS 5. DORKING—Silver Grey. Cock.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. Countess of Home, The Hirsel, Coldstream.
3. Arthur C. Major, Park Farm, Ditton, Langley, Bucks.
V. W. B. Dickinson, Longcroft, Lauder.
H. John Laing, Burnside, Auchtermuchty.
C. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
C. David M'Gibbon, Ard-na-Craig, Campbeltown.

CLASS 6. DORKING—Silver Grey. Hen.

1. David M'Gibbon, Ard-na-Craig, Campbeltown.
2. A. W. Smith, Forglen House, Turriff.
3. W. B. Dickinson, Longcroft, Lauder.
V. John Laing, Burnside, Auchtermuchty.
V. Thomas Rae, Craighlaw, Kirkcowan.
H. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
H. George M'Bain, Linkwood, Elgin.
C. John Howie, Boghead, Craigie, Kilmarnock.

CLASS 7. DORKING—Silver Grey. Cockerel.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. John Howie, Boghead, Craigie, Kilmarnock.
3. George M'Bain, Linkwood, Elgin.
V. George M'Bain, Linkwood, Elgin.
C. W. B. Dickinson, Longcroft, Lauder.

CLASS 8. DORKING—Silver Grey. Pullet.

1. George M'Bain, Linkwood, Elgin.
2. John Howie, Boghead, Craigie, Kilmarnock.
3. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
V. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.
H. George M'Bain, Linkwood, Elgin.
C. Robert Reid, 706 New City Road, Glasgow.

CLASS 9. COCHIN-CHINA. Cock.

1. H. Pickles, Earby, Colne.
2. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.

CLASS 10. COCHIN-CHINA. Hen.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.
2. H. Pickles, Earby, Colne.

CLASS 11. BRAHMAPOOTRA. Cock.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.
2. Mrs J. D. Davidson, Knockomie, Forres.
3. H. Pickles, Earby, Colne.

CLASS 12. BRAHMAPOOTRA. Hen.

1. H. Pickles, Earby, Colne.
2. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.
3. Mrs J. D. Davidson, Knockomie, Forres.

CLASS 13. BRAHMA or COCHIN. Cockerel.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Brahma).
2. Lewis Souter, High Street, Dingwall (Light Brahma).

CLASS 14. BRAHMA or COCHIN. Pullet.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Brahma).
2. Countess of Home, The Hirsel, Coldstream (Dark Brahma).

CLASS 15. SCOTCH GREY. Cock.

1. David M'Gibbon, Ard-na-Craig, Campbeltown.
2. William Watson, Home Farm, Cawdor Castle, Nairn.
V. David M'Gibbon, Ard-na-Craig, Campbeltown.
V. David M'Gibbon, Ard-na-Craig, Campbeltown.
C. David M'Gibbon, Ard-na-Craig, Campbeltown.

CLASS 16. SCOTCH GREY. Hen.

1. David M'Gibbon, Ard-na-Craig, Campbeltown.
2. David M'Gibbon, Ard-na-Craig, Campbeltown.
V. William Watson, Home Farm, Cawdor Castle, Nairn.

CLASS 17. SCOTCH GREY. Cockerel.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2. Alexander Hamilton, Braidwood Tile Works, Carluke.
V. David M'Gibbon, Ard-na-Craig, Campbeltown.
H. David M'Gibbon, Ard-na-Craig, Campbeltown.
C. William Watson, Home Farm, Cawdor Castle, Nairn.

CLASS 18. SCOTCH GREY. Pullet.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2. Alexander Hamilton, Braidwood Tile Works, Carluke.
V. David M'Gibbon, Ard-na-Craig, Campbeltown.
H. William Watson, Home Farm, Cawdor Castle, Nairn.

CLASS 19. HAMBURG—Black. Cock.

1. Countess of Home, The Hirsel, Coldstream.
2. Alexander Fraser, White Bridge, Cawdor, Nairn.

CLASS 20. HAMBURG—Black. Hen.

1. George Gibb, Maybank, East Calder.
2. H. Pickles, Earby, Colne.
3. Peter Houston, 25 High Street, Dumbarton.

CLASS 21. HAMBURG—Any other Variety. Cock.

1. H. Pickles, Earby, Colne (Silver-spangled).
2. H. Pickles, Earby, Colne (Silver pencilled).

CLASS 22. HAMBURG—Any other Variety. Hen.

1. J. M. Campbell, Bonny Kelly, New Pitsligo (Silver-spangled).
2. J. M. Campbell, Bonny Kelly, New Pitsligo (Silver-spangled).
3. Countess of Home, The Hirsel, Coldstream (Golden pencilled).

CLASS 23. HAMBURG—Any Variety. Cockerel.

1. H. Pickles, Earby, Colne (Golden pencilled).

CLASS 24. HAMBURG—Any Variety. Pullet.

1. Maurice Jackson, High Green Farm, Silsden, *viâ* Keighley, Yorkshire.
2. H. Pickles, Earby, Colne (Black).

CLASS 25. PLYMOUTH ROCK. Cock.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. John B. Tulloch, The Dales, Inverkeithing.
3. R. Waddell, Barnsdale Cottage, St Ninians.
V. Lockwood & Gill, Pateley Bridge, Yorkshire.
H. Alexander D. Watt, Pretoria Cottage, Downfield, Dundee.
C. Alexander M'Kenzie, jun., Knockbain Farm, Dingwall.

CLASS 26. PLYMOUTH ROCK. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
3. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.

CLASS 27. PLYMOUTH ROCK. Cockerel.

1. W. & A. Thomson, Drumburn, New Abbey, Dumfries.
2. Alexander M. Prain, Rawes, Longforgan.
3. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
V. R. Waddell, Barnsdale Cottage, St Ninians.
H. James Glen, 5 West Breast, Greenock.
C. R. Waddell, Barnsdale Cottage, St Ninians.

CLASS 28. PLYMOUTH ROCK. Pullet.

1. W. & A. Thomson, Drumburn, New Abbey, Dumfries.
2. Edward Wilson, Millhouse, Middleton, Kirkby Lonsdale, Westmoreland.
3. Alexander M. Prain, Rawes, Longforgan.
V. James Glen, 5 West Breast, Greenock.
H. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
C. Robert Waddell, Barnsdale Cottage, St Ninians, Stirling.

CLASS 29. MINORCA. Cock.

1. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.
2. Countess of Home, The Hirsel, Coldstream.
3. Alexander M. Prain, Rawes, Longforgan.
V. John Gillies, Edington Mills, Chirnside.
H. Alexander M'Kenzie, jun., Knockbain Farm, Dingwall.
C. Andrew Buchanan, 33 James Place, Dunfermline.

CLASS 30. MINORCA. Hen.

1. D. Stevenson, Sauchenbush, Kirkcaldy.
2. Robert Reid, 706 New City Road, Glasgow.
3. Alexander M. Prain, Rawes, Longforgan.
V. Alexander M'Kenzie, jun., Knockbain Farm, Dingwall.
H. Countess of Home, The Hirsel, Coldstream.
C. S. Dalgliesh, Blackburn, Chirnside. .

CLASS 31. MINORCA. Cockerel.

1. Alexander M. Prain, Rawes, Longforgan.
2. Countess of Home, The Hirsel, Coldstream.
3. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
V. John W. Crossman, The Shrubberies, Galphay, Ripon, Yorkshire.
C. Hynd & Cruickshank, Woodend, Armadale.

CLASS 32. MINORCA. Pullet.

1. Countess of Home, The Hirsel, Coldstream.
2. John W. Crossman, The Shrubberies, Galphay, Ripon, Yorkshire.
3. Alexander M. Prain, Rawes, Longforgan.
V. R. Waddell, Barnsdale Cottage, St Ninians.
H. James Laidler, 3 Park Terrace, Paisley.
C. Robert Fitton, Ribby Hall, Kirkham, Lancashire.

CLASS 33. LEGHORN—White. Cock.

1. Alexander M. Prain, Rawes, Longforgan.
2. A. Ogilvie, Drummuir Station, Keith.
V. Mrs Frank Anderson, 130 Main Street, Aberchirder.
H. Donald Allan, Evanton, Ross-shire.

CLASS 34. LEGHORN—White. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. Paterson Brothers, South Barrwood Cottage, Kilsyth.
3. Moir Robertson, Cairneyhill, Dunfermline.

V. George Shiell, The Lodge, Drummuir, Keith.
H. Laurence Anderson, Reform Street, Dunfermline.
C. William Bell, 245 Links Street, Kirkcaldy.

CLASS 35. LEGHORN—Any other Variety. Cock.

1. David Mealls, jun., Dunipace, Denny (Brown).
2. Rundle Brothers, Main Street, New Milns (Brown).
3. George M'Alpine, Townhead, Meikle Earnock, Hamilton (Brown).
V. Robert Durward, Dunecht, Aberdeenshire (Brown).

CLASS 36. LEGHORN—Any other Variety. Hen.

1. Alexander M. Prain, Rawes, Longforgan (Brown).
2. David Mealls, jun., Dunipace, Denny (Brown).
3. William Keys, Kintore (Brown).
V. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.
H. Robert Durward, Dunecht, Aberdeenshire (Brown).
H. William Keys, Kintore (Brown)
C. George M'Alpine, Townhead, Meikle Earnock, Hamilton (Brown).

CLASS 37. LEGHORN—Any Variety. Cockerel.

1. Alexander M. Prain, Rawes, Longforgan (White).
2. Samuel Hannah, Laigh Tongue, Darvel, Ayrshire (Brown).
3. R. Waddell, Barnsdale Cottage, St Ninians (White).
V. A. Ogilvie, Drummuir Station, Keith (White).
H. Laurence Anderson, Reform Street, Dunfermline (White).
H. Robert Durward, Dunecht, Aberdeenshire (Brown).
H. John Skinner, jun., Forthbank, Kirkcaldy (White).
H. William Watson, Craigton Farm, Clackmannan (Brown).
C. George M'Alpine, Townhead, Meikle Earnock (Brown).

CLASS 38. LEGHORN—Any Variety. Pullet.

1. Samuel Hannah, Laigh Tongue, Darvel, Ayrshire (Brown).
2. Alexander M. Prain, Rawes, Longforgan (White).
3. Falconer & Kidd, 34½ Hall Street, Lochgelly (Brown).
V. Robert Durward, Dunecht, Aberdeenshire (Brown).
V. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.
V. R. Waddell, Barnsdale Cottage, St Ninians (White).
H. R. Waddell, Barnsdale Cottage, St Ninians (White).
C. Brothers Watters, Milnathort (Brown).

CLASS 39. LANGSHAN. Cock.

1. D. Stevenson, Sauchenbush, Kirkcaldy.
2. Brothers Richardson, Muir, Bannockburn.

CLASS 40. LANGSHAN. Hen.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff.
2. D. Stevenson, Sauchenbush, Kirkcaldy.

CLASS 41. ORPINGTON. Cock.

1. H. & E. Eltringham, Blackhill, Durham.
2. Rev. W. M'Beath, Halkirk.
3. Alexander M. Prain, Rawes, Longforgan.

CLASS 42. ORPINGTON. Hen.

1. Rev. W. M'Beath, Halkirk.
2. H. & E. Eltringham, Blackhill, Durham.
3. Lockwood & Gill, Pateley Bridge, Yorkshire.

CLASS 43. LANGSHAN or ORPINGTON. Cockerel.

1. Countess of Home, The Hirsel, Coldstream (Orpington).
2. H. & E. Eltringham, Blackhill, Durham (Orpington).
3. R. Waddell, Barnsdale Cottage, St Ninians (Buff).

CLASS 44. LANGSHAN or ORPINGTON. Pullet.

1. John B. Tulloch, The Dales, Inverkeithing (Orpington).
2. Countess of Home, The Hirsel, Coldstream (Orpington).
3. R. Waddell, Barnsdale Cottage, St Ninians (Orpington).

CLASS 45. WYANDOTTE—Gold or Silver. Cock.

1. D. Stevenson, Sauchenbush, Kirkcaldy (Silver).
2. Alexander Campbell, Balnabeen, Conon (Gold).
3. H. Pickles, Earby, Colne.

CLASS 46. WYANDOTTE—Gold or Silver. Hen.

1. Thomas Middleton, Corntown, Conon Bridge (Silver).
2. D. Stevenson, Sauchenbush, Kirkcaldy (Silver).
3. Lockwood & Gill, Pateley Bridge, Yorkshire (Silver).

CLASS 47. WYANDOTTE—Any other Variety. Cock.

1. John Wharton, Honeycott, Hawes, Yorkshire (Partridge).
2. Lockwood & Gill, Pateley Bridge, Yorkshire (Buff).

CLASS 48. WYANDOTTE—Any other Variety. Hen.

1. Miss Mackay, Rottearns House, Braco, Perthshire (Buff).
2. John Wharton, Honeycott, Hawes, Yorkshire (Partridge).

CLASS 49. WYANDOTTE—Any Variety. Cockerel.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Silver).
2. John Simpson, Buckie (Gold).
3. Rev. W. M'Beath, Halkirk (Silver.)

CLASS 50. WYANDOTTE—Any Variety. Pullet.

1. Rev. W. M'Beath, Halkirk (Silver).
2. Maurice Jackson, High Green Farm, Silsden, *via* Keighley, Yorkshire (Buff).
3. Lockwood & Gill, Pateley Bridge, Yorkshire (Silver).
V. John Wharton, Honeycott, Hawes, Yorkshire (Buff).

CLASS 51. GAME—Old English. Cock.

1. Ernest Grant, Baron Hill, Forfar.
2. H. Pickles, Earby, Colne.
3. Ernest Grant, Baron Hill, Forfar.
V. W. B. Dickinson, Longcroft, Lauder.
V. John Hutt, Denend, Cardenden.
H. Armstrong & Paull, 275 Watling Street, Leadgate, Durham.

CLASS 52. GAME—Old English. Hen.

1. Ernest Grant, Baron Hill, Forfar.
2. Ernest Grant, Baron Hill, Forfar.
V. H. Pickles, Earby, Colne.
H. Armstrong & Paull, 275 Watling Street, Leadgate, Durham.
C. John Hutt, Denend, Cardenden.

CLASS 53. GAME—Indian. Cock.

1. Rev. W. M'Beath, Halkirk.
2. William A. Black, Croftfoot, Polmont.
3. John Penman, Albyn Villa, Fairfield Road, Inverness.
V. George Hunter, Melrose.
V. John Laing, Burnside, Auchtermuchty.
H. Hunter & Digman, School Row, Townhill, Dunfermline.
C. West Highland Poultry Yards, Duart, Craignure, Isle of Mull.

CLASS 54. GAME—Indian. Hen.

1. William A. Black, Croftfoot, Polmont.
2. Rev. W. M'Beath, Halkirk.
3. Hunter & Digman, School Row, Townhill, Dunfermline.
V. George Hunter, Melrose.
V. John Penman, Albyn Villa, Fairfield Road, Inverness.
C. West Highland Poultry Yards, Duart, Craignure, Isle of Mull.

CLASS 55. GAME—Modern. Cock.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. Adam Innes, 3 Back Lane, Sinclairtown, Kirkcaldy (Black Red).
V. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Pile).

CLASS 56. GAME—Modern. Hen.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire.
2. Walter B. Longton, Walkinshaw, Renfrew (Black Red).
V. Alexander Dunbar, Baker, Dingwall (Duckwing).
H. Alexander Dunbar, Baker, Dingwall (Black Red).

CLASS 57. GAME—Any Variety, including Old English and Indian. Cockerel.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Modern).
2. R. Reid, Glasgow Road Bridge, Kirkintilloch (Pile).
V. John Penman, Albyn Villa, Fairfield Road, Inverness (Indian).
H. Alexander Dunbar, Baker, Dingwall (Pile).

CLASS 58. GAME—Any Variety, including Old English and Indian. Pullet.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Modern).

CLASS 59. BANTAM—Game, any Variety, including Old English and Indian. Cock.

1. William Henderson, 41 Rumbling Well, Dunfermline (Pile).
2. Lewis Urquhart, 18 Kingsmills Road, Inverness (Pile).
V. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Game).

CLASS 60. BANTAM—Game, any Variety, including Old English and Indian. Hen.

1. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Game).
2. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr (Game).

CLASS 61. BANTAM—Any other Variety Bantam. Cock.

1. Lady Margaret Douglas Home, The Hirsel, Coldstream (Black Rose Comb).
2. Archibald Niven, Home Farm, Lennoxtown (Buff).
3. John Gillies, Edington Mills, Chirnside (Sebright).
V. Robert Frew, The Barony, Cupar-Fife (Sebright).
V. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr (Buff Pekin).
V. A. Robertson, Barholm, Kilbarchan (Black Rose Comb).
H. H. Pickles, Earby, Colne (Black Rose Comb).

CLASS 62. BANTAM—Any other Variety Bantam. Hen.

1. John Gillies, Edington Mills, Chirnside (Black Rose Comb).
2. Lady Margaret Douglas Home, The Hirsel, Coldstream (Black Rose Comb).
3. H. Pickles, Earby, Colne (Black Pekin).
V. Robert Frew, The Barony, Cupar-Fife (Pekin).
V. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr (Black Pekin).
H. John Page, Hydropathic, Dunblane (Light Brahma).
C. Robert Frew, The Barony, Cupar-Fife (Pekin).

CLASS 63. Any other recognised Breed of Poultry. Cock.

1. David M'Gibbon, Ard-na-Craig, Campbeltown (Spanish).
2. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Poland).

CLASS 64. Any other recognised Breed of Poultry. Hen.

1. David M'Gibbon, Ard-na-Craig, Campbeltown (Spanish).
2. Robert Fitton, Ribby Hall, Kirkham, Lancashire (Poland).
3. John Meikle, Auchencruive Estates Office, Mount Hamilton, Ayr (Spanish).

CLASS 65. Any other recognised Breed of Poultry. Cockerel.

1. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
2. David Hastings, Glaister Cottage, Darvel, Ayrshire (Creve Cœur).
3. West Highland Poultry Yards, Duart, Craignure, Isle of Mull (Lincoln Buff).

CLASS 66. Any other recognised Breed of Poultry. Pullet.

1. David Hastings, Glaister Cottage, Darvel (Creve Cœur).
2. West Highland Poultry Yards, Duart, Craignure, Isle of Mull (Lincoln Buff).

CLASS 67. DUCKS—Aylesbury. Drake.

1. Countess of Home, The Hirsel, Coldstream.
2. John Gillies, Edington Mills, Chirnside.
3. Countess of Home, The Hirsel, Coldstream.

CLASS 68. DUCKS—Aylesbury. Duck.

1. Countess of Home, The Hirsel, Coldstream.
2. John Gillies, Edington Mills, Chirnside.
3. Countess of Home, The Hirsel, Coldstream.

CLASS 69. DUCKS—Aylesbury. Drake (Young).

1. Countess of Home, The Hirsel, Coldstream.
2. John Gillies, Edington Mills, Chirnside.
3. John Gillies, Edington Mills, Chirnside.

CLASS 70. DUCKS—Aylesbury. Duck (Young).

1. *Countess of Home, The Hirsel, Coldstream.*
2. John Gillies, Edington Mills, Chirnside.
3. Countess of Home, The Hirsel, Coldstream.

CLASS 71. DUCKS—Rouen. Drake.

1. John Gillies, Edington Mills, Chirnside.
2. Countess of Home, The Hirsel, Coldstream.

CLASS 72. DUCKS—Rouen. Duck.

1. John Gillies, Edington Mills, Chirnside.
2. Peter Houston, 25 High Street, Dumbarton.

CLASS 73. DUCKS—Any other Variety. Drake.

1. S. Dalgliesh, Blackburn, Chirnside (Pekin).
2. Rev. W. M'Beath, Halkirk (Indian).
3. Rev. W. M'Beath, Halkirk (Pekin).

CLASS 74. DUCKS—Any other Variety. Duck.

1. S. Dalgliesh, Blackburn, Chirnside (Pekin).
2. S. Dalgliesh, Blackburn, Chirnside (Pekin).
3. Rev. W. M'Beath, Halkirk (Indian).
V. Owen Phillipps, Bredon Lodge, Tewkesbury, Gloucester (Pekin).

CLASS 75. DUCKS—Any Breed (Aylesbury excepted). Drake (Young).

1. Rev. W. M'Beath, Halkirk (Pekin).
2. John Gillies, Edington Mills, Chirnside (Rouen).
3. Countess of Home, The Hirsel, Coldstream (Rouen).

CLASS 76. DUCKS—Any Breed (Aylesbury excepted). Duck (Young).

1. John Gillies, Edington Mills, Chirnside (Rouen).
2. Countess of Home, The Hirsel, Coldstream (Rouen).
3. Rev. W. M'Beath, Halkirk (Pekin).

CLASS 77. GEESE. Gander.

1. John Page, Hydropathic, Dunblane (Embden).
2. Walter B. Longton, Walkinshaw, Renfrew (Toulouse).

CLASS 78. GEESE. Goose.

1. D. J. Thomson Gray, Innerpeffrey Lodge, Crieff (Embden).
2. Miss Shanks, Cuthelton Farm, Denny (Toulouse).

CLASS 79. TURKEYS. Cock.

1. W. A. Cumming, Allanfearn, Inverness (American Bronze).
2. Mrs Alexander Birnie, Wellhouse, Beauly (American Bronze).

CLASS 80. TURKEYS. Hen.

1. W. A. Cumming, Allanfearn, Inverness (American Bronze).
2. John Page, Hydropathic, Dunblane (Bronze).

DAIRY PRODUCE

CLASS 1. CURED BUTTER, not less than 7 lb.—Premiums, £4, £2, and £1.

1. William Whyte, Middlepenny, Langbank.
2. Henry Orr, Torrance, Blackridge, Westcraigs.
3. Robert Gilmour, Stonebyres, Eaglesham.
V. Andrew Fleming, Threepland, Eaglesham.
H. William Paterson, Barnego, Denny.
C. Alexander Fleming, Enoch, Eaglesham.

CLASS 2. POWDERED BUTTER, not less than 7 lb.—Premiums, £4, £2, and £

1. Robert Gilmour, Stonebyres, Eaglesham.
2. William Paterson, Barnego, Denny.
3. William Whyte, Middlepenny, Langbank.
V. Andrew Fleming, Threepland, Eaglesham.
H. Alexander Fleming, Enoch, Eaglesham.
C. Henry Orr, Torrance, Blackridge, Westcraigs.

CLASS 3. FRESH BUTTER, Three 1-lb. Rolls.—Premiums, £4, £2, and £1.

1. William Paterson, Barnego, Denny.
2. R. G. Murray, Spittal, Biggar.
3. William Whyte, Middlepenny, Langbank.
V. Andrew Fleming, Threepland, Eaglesham.
H. Robert Gilmour, Stonebyres, Eaglesham.
C. Northern Creameries, Limited, Huntly.

CLASS 4. CHEDDAR CHEESE, 56 lb. and upwards.—
Premiums, £6, £4, £2, and £1.

1. Matthew Kerr, Craiglemine Farm, Whithorn, N.B.
2. Adam Henry, Culmore Farm, Stoneykirk, Stranraer.
3. Alexander Cross of Knockdon, Maybole.

CLASS 5. CHEDDAR CHEESE, 14 lb. and under.—
Premiums, £3, £2, and £1.

1. Alexander Cross of Knockdon, Maybole.
2. Matthew Kerr, Craiglemine Farm, Whithorn.

JUDGES

Shorthorn.—J. T. M'Laren, Polmaise, Stirling; James Peter, Berkeley Castle Estate Office, Berkeley, Gloucestershire.

Aberdeen-Angus.—Arch. Whyte, Inverquharity, Kirriemuir; George J. Walker, Portlethen, Aberdeen.

Galloway.—Samuel Thomson, Buxley, Duns.

Highland. — Robert Macdiarmid, Castles, Lochawe, Argyllshire.

Ayrshire.—Adam Montgomerie, Lessnessock, Ochiltree.

Fat Cattle.—Samuel Davidson, Beech Hill, Inverness.

Stallions, Colts, and Draught Geldings.—James Weir, Sandilands, Lanark; W. R. Trotter, South Acomb, Stocksfield-on-Tyne.

Mares and Fillies.—J. P. Sleigh, Hillhead, Crimond, Lonmay; David A. Hood, Balgreddan, Kirkcudbright.

Hunters.—William Taylor, Park Mains, Renfrew.

Hackneys. — Richard Ford, Chevet Grange, Wakefield.

Ponies.—Gavin Hadden, Dalmuinzie, Murtle, Aberdeen.

Highland Ponies.—Sir John Gilmour of Montrave, Bart., Leven, Fifeshire; James E. B. Baillie of Dochfour, Inverness.

Shetland Ponies. — Alex. Durno, 62 Great Western Road, Aberdeen.

Blackfaced. — Thomas Watters, Glenample, Lochearnhead; William Gordon, Auchallater, Braemar.

Cheviot.—Andrew T. Elliot, Newhall, Galashiels; Charles Scott, Milsington, Hawick.

Border Leicester. — Andrew Smith, Longniddry; John Hunter, Dipple, Fochabers.

Half-Bred. — Thomas Elliot, Attonburn, Kelso.

Shropshire. — Wm. Murray, Kilcoy, Killarnan, Ross-shire.

Oxford Down and Suffolks.—James T. Hobbs, Maisey Hampton, Fairford, Gloucestershire.

Fat Sheep.—Alex. Macdonald, Balintore, Kirkhill, Inverness.

Swine.—James Lawrence, Forres Mills, Forres.

Dairy Produce.—James Weir, Brunswick Street, Glasgow.

Wool. — John C. M'Ewen, Trafford Bank, Inverness.

Poultry.—John Cran, Keith (classes 9 to 14 inclusive, classes 19 to 24 inclusive, classes 39 to 50 inclusive, and classes 63 to 80 inclusive); A. K. Crichton, Estates Office, Penshurst, Bridge of Weir (classes 1 to 8 inclusive, classes 15 to 18 inclusive, classes 25 to 38 inclusive, and classes 51 to 62 inclusive).

DISTRICT COMPETITIONS.

9	Districts—	Grants of £12 each (Section I.)	£108	0	0
10	"	Grants of £15 each (Section II.)	150	0	0
6	"	Special Grants	74	0	0
94	"	Medals for Shows	59	18	6
27	"	Medals for Cottages and Gardens	6	10	6
214	"	Medals for Ploughing	51	14	4
360			£450	3	4

VETERINARY DEPARTMENT.

33 Silver Medals	£21	0	9

ABSTRACT OF PREMIUMS.

Inverness Show	£2377	2	7
District Competitions	450	3	4
Veterinary Colleges	21	0	9
	£2848	6	8

STATE OF THE FUNDS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

As at 30th NOVEMBER 1901.

I. Heritable Bonds—						
£11,500 at 3½ per cent, £11,500 at 3¼ per cent, £11,500 at 3 per cent				£34,500	0	0
II. Debenture and Preference Stocks—						
£4,250 N.B. Railway Co. 3 per cent, at 99	£4,207	10	0			
£2,727 Caled. Railway Co. 4 per cent, at 134	3,651	3	7			
£2,347 London and North-Western Railway Company 3 per cent, at 102½	2,405	13	6			
£1,212 Mid. Railway Co. 2½ per cent, at 83½	1,012	0	5			
£2,400 Do. do. Preference Stock 2½ per cent, at 78	1,872	0	0			
£2,036 N E Railway Co. 3 per cent, at 101½	2,066	10	9			
£2,026 Gt. N. Railway Co. 3 per cent, at 100½	2,036	2	7			
				17,254	0	10
III. Bank Stocks—						
£6,407 7 8 Royal Bank of Scotland, at 244½	£15,666	0	0			
2,218 16 5 Bank of England, at 332½	7,377	10	0			
2,500 0 0 British Linen Co. Bank, at 483	12,075	0	0			
2,341 13 4 Bank of Scotland, at 330	7,727	10	0			
£13,467 17 5				42,846	0	0
The original cost of these Bank Stocks was £23,632, 9s. 4d., showing a profit at present prices of £19,213, 10s. 8d.						
IV. Estimated Value of Building, No. 3 George IV. Bridge				3,100	0	0
V. Estimated Value of Furniture, Paintings, Books, &c.				1,000	0	0
VI. Arrears of Subscriptions considered recoverable				95	2	0
VII. Balance due by Royal Bank of Scotland on Accounts Current, at 30th November 1901				1,519	7	4
Amount of General Funds				£100,314	10	2
VIII. Tweeddale Medal Fund—						
Heritable Bond, at 3½ per cent				£500	0	0
IX. The Robert Murdoch Prize Fund—						
Legacy by the late Miss Murdoch, Blantyre, to be applied in giving a prize of £10 a-year, while it lasts, to the Breeder of the best Clydesdale Brood Mare at the Annual Show of the Society, £100, less duty.						
Amount per last account, including interest				£73	5	2
Interest on Deposit Receipt, dated 2nd October 1900, and uplifted 4th October 1901				1	13	7
				£74	18	9
Transferred to Stirling Show Account				10	0	0
On Deposit Receipt with Royal Bank, dated 4th October 1901				£64	18	9

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILMOUR, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

Edinburgh, 8*th January* 1902.

VIEW OF RECEIPTS AND PAYMENTS
For the Year 1900-1901.

RECEIPTS.

1. ANNUAL SUBSCRIPTIONS AND ARREARS received		£992 19 0
2. LIFE SUBSCRIPTIONS		737 15 0
		£1,730 14 0
3. INTERESTS AND DIVIDENDS—		
Interests	£1,536 15 4	
Dividends	1,643 12 1	
		3,180 7 5
4. TRANSACTIONS		53 6 0
5. RECEIPTS from Inverness Show		6,268 14 11
SUM OF RECEIPTS		£11,233 2 4

PAYMENTS.

1. ESTABLISHMENT EXPENSES—			
Salaries and Wages		£1,348 13 4	
Feu-duty, Taxes, Coal, Gas, Insurance, Repairs, and Furnishings		163 2 8	
		£1,511 16 0	
2. FEE TO AUDITOR of Accounts for 1899-1900		50 0 0	
3. EDUCATION		180 7 0	
4. CHEMICAL DEPARTMENT		370 7 7	
5. VETERINARY DEPARTMENT		180 7 11	
6. BOTANICAL DEPARTMENT		35 1 0	
7. DAIRY DEPARTMENT		123 12 3	
8. TRANSACTIONS		705 1 8	
9. ORDINARY Printing, Advertising, Stationery, Postages, Bank Charges, &c.		190 17 0	
10. GRANTS to Public Societies		25 0 0	
11. MISCELLANEOUS PAYMENTS		79 5 11	
12. INVESTMENTS MADE	£2,045 19 6		
13. PAYMENTS in connection with Edinburgh Show		10 0 0	
14. PAYMENTS in connection with Stirling Show		134 19 7	
15. PAYMENTS in connection with Inverness Show—			
Premiums	£2,264 12 7		
General Expenses	3,813 6 3		
		6,077 18 10	
16. PREMIUMS and Medals for District Competitions and Local Shows		460 16 8	
17. AMOUNT of Prize Money for Essay, returned to donor, prize not having been awarded		10 0 0	
SUM OF PAYMENTS			10,145 11 5
BALANCE OF RECEIPTS			£1,087 10 11

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILMOUR, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 8*th January* 1902.

ABSTRACT of the ACCOUNTS of the HIGHLAND and

CHARGE.

1. BALANCE due by Royal Bank of Scotland on account current at 30th November 1900			£2,477 15 11
2. ARREARS of Subscriptions outstanding at 30th Nov. 1900		£97 17 0	
Whereof due by Members who have compounded for life, and whose arrears are thereby extinguished	£6 3 6		
Sums ordered to be written off .	40 15 0		
		46 18 6	
			50 18 6
3. INTERESTS AND DIVIDENDS—			
(1) Interests—			
On Heritable Bonds, less Income-tax .		£1,059 10 1	
On Debenture Stocks, do. . .		434 10 8	
On Deposit Receipts		42 14 7	
		£1,536 15 4	
(2) Dividends on Bank Stocks . .		1,643 12 1	
			3,180 7 5
4. SUBSCRIPTIONS—			
Annual Subscriptions . . .		£1,081 18 0	
Life Subscriptions		737 15 0	
			1,819 13 0
5. TRANSACTIONS—Sales and Advertisements			53 6 0
6. RECEIPTS from Inverness Show			6,268 14 11
SUM OF CHARGE . .			£13,850 15 9

AGRICULTURAL SOCIETY of SCOTLAND for the Year 1900-1901.

DISCHARGE.

1. Establishment Expenses—			
Salaries and Wages			£1,348 13 4
Feu-duty, £28 ; Taxes, £44, 7s.			72 7 0
Coals and Gas			26 1 8
Insurances			16 14 8
Repairs and Furnishings—Special, £17, 5s. ; Ordinary, £30, 14s. 4d.			47 19 4
			£1,511 16 0
2. Fee to Auditor of Accounts for 1899-1900			50 0 0
3. Education—			
(1) Forestry—			
(1) Vote to Chair in Edinburgh University		£50 0 0	
(2) Fees to Examiners and Outlays		17 3 0	
		£67 3 0	
(2) Agriculture—Expenses of National Diploma Examination at Leeds		113 4 0	
			180 7 0
4. Chemical Department—			
(1) Salary to Dr A. P. Aitken		£50 0 0	
(2) Chemists' Fees and Expenses—Fees for Analyses to Members, £64, 19s. ; Do of Oats and Oat Straws and Report thereon, £46 ; Expenses visiting Experiments, £29, 7s. 10d.		140 6 10	
(3) Expenses of Manuring and Sheep-Grazing Experiments, £229, 8s. 3d.—*Less* proceeds of Sheep sold, £49, 7s. 6d.		180 0 9	
			370 7 7
5. Veterinary Department—Tuberculous Research, £129, 7s. 2d. ; Braxy Experiments, £30 ; Medals, £21, 0s. 9d.			180 7 11
6. Botanical and Entomological Department—Fee to Botanist for year, £25 ; Investigation as to Disease in Turnips, £10, 1s.			35 1 0
7. Dairy Department—			
(1) Expense of Conference of British Dairy Farmers' Association held in Edinburgh		£11 4 8	
(2) Examination at Kilmarnock—Fees to Examiners, £32, 3s. ; Expenses, including Hotel Bills, £27, 4s. 7d.	£59 7 7		
Less—Fees forfeited by unsuccessful Candidates	7 0 0		
		52 7 7	
(3) Special Grant—Vote to Dairy School at Kilmarnock		60 0 0	
			123 12 3
8. Transactions			705 1 8
9. Ordinary Printing, £80, 8s. 8d ; Advertising, £12, 15s. 8d.; Stationery, &c., £34, 11s. 5d. ; Postages, £55 ; Charges, &c., £8, 1s. 3d.			190 17 0
10. Grants to Public Societies—Scottish Meteorological Society, £20 ; Society for Prevention of Cruelty to Animals, £5			25 0 0
11. Miscellaneous Payments			79 5 11
12. Investments made			2,045 19 6
13. Payments in connection with Edinburgh Show, 1899—Premium			10 0 0
14. Payments in connection with Stirling Show, 1900—Premiums, £129 ; Miscellaneous Payments, £5, 19s. 7d.			134 19 7
15. Payments in connection with Inverness Show, 1901—Premiums, £2252, 5s. 10d. ; Medals, £12, 6s. 9d. ; Expenses, £3813, 6s. 3d.			6,077 18 10
16. Premiums and Medals for District Competitions and Local Shows—Premiums, £263 ; Medals, £99, 16s. 8d. ; Special Grants, £98			460 16 8
17. Amount of Prize Money for Essay returned to Donor, prize not having been awarded			10 0 0
18. Arrears struck off as irrecoverable			44 15 6
19. Arrears outstanding at 30th November 1901			95 2 0
20. Balances due by Royal Bank on Account Current			1,519 7 4
Sum of Discharge			£13,850 15 9

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILMOUR, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

Edinburgh, *8th January* 1902.

ABSTRACT of the ACCOUNTS

CHARGE.

1. LOCAL SUBSCRIPTIONS—

Inverness-shire	Voluntary Assessment	£767	8	9
Ross-shire and Cromartyshire	" "	379	18	6
*Nairnshire	" "	—		
Caithness-shire	" "	108	8	7
Sutherlandshire (did not contribute)		—		
Morayshire	General Subscription	105	18	2
Town of Inverness	Donation	52	10	0
Inverness-shire Farmers' Society	"	75	0	0
Easter Ross Farmers' Club	"	40	0	0
Wester Ross "	"	25	0	0
Nairnshire Farming Society	"	20	0	0
Duke of Sutherland	"	25	0	0
George Bullough of Rum	"	25	0	0
Andrew Carnegie of Skibo	"	25	0	0
Walter Shoolbred of Wyvis	"	25	0	0
Earl Cawdor	"	20	0	0
		£1,694	4	0

2. AMOUNT COLLECTED DURING SHOW—

Drawn at Gates	£1,947	5	0			
Drawn at Grand Stand	344	2	11			
Catalogues and Awards sold	180	18	8			
Cloak-Rooms	4	8	1			
				2,476	14	8

3. FORAGE SOLD	8	0	3
4. RENT OF STALLS	1,587	3	0
5. RENT OF REFRESHMENT BOOTHS	200	0	0
6. ADVERTISEMENTS IN CATALOGUE AND PREMIUM LIST	89	2	3
7. SPECIAL PRIZES CONTRIBUTED	193	15	0
8. INCOME FROM TWEEDDALE MEDAL FUND	16	10	10
9. INTEREST FROM ROYAL BANK	3	4	11
	£6,268	14	11

Note.—From the above balance of	£190	16	1
There have to be deducted the premiums undrawn at 30th November, amounting to	112	10	0
Making the probable Surplus	£78	6	1

* Subscription from Nairnshire, received since close of financial year, £20, 11s. 7d., making the probable surplus £98, 17s. 8d.

of the INVERNESS SHOW, 1901.

DISCHARGE.

1. SHOWYARD EXPENDITURE—						
Fitting up Showyard				£2,259	9	5
Rosettes				25	18	1
Penning, &c., of Poultry, £9, 0s. 6d.; Mowing Grass in Showyard, £5, 15s. 6d.				14	16	0
Railway, &c., Carriages, £10, 14s. 10d.; Miscellaneous, £9, 4s. 10d.				19	19	8
				£2,320	3	2
2. FORAGE				388	16	9
3. POLICE				42	0	0
4. TRAVELLING EXPENSES of Judges, Stewards, &c.				127	19	3
5. HOTEL AND LUNCHEONS—						
Hotel Bill for 36 Directors, 8 Stewards, 31 Judges, &c.	£175	10	0			
Luncheons and Breakfasts in Showyard for Directors, Judges, Attending Members, &c.	173	13	4			
				349	3	4
6. MUSIC				51	0	0
7. PRINTING				217	2	2
8. ADVERTISING and Bill-posting				85	9	0
9. HIGHLAND INDUSTRIES				7	0	0
10. VETERINARY INSPECTION				10	10	0
11. CONCERT for Attendants				3	1	0
12. ASSISTANTS and Attendants				152	2	11
13. POSTAGES				49	0	0
14. MISCELLANEOUS				9	18	8
AMOUNT OF GENERAL EXPENDITURE				£3,813	6	3
15. PREMIUMS drawn at 30th November				2,264	12	7
				£6,077	18	10
BALANCE OF RECEIPTS				190	16	1
				£6,268	14	11

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILMOUR, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, *8th January* 1902.

ABSTRACT of the ACCOUNTS of the

CHARGE.

I. FUNDS as at 30th November 1900—		
£3,193, 6s. 8d. 3 per cent Debenture Stock of the North British Railway Company, purchased at		£2,650 0 0
Amount on Loan over the Earl of Minto's Estates at 3 per cent		3,500 0 0
£550 Lancashire and Yorkshire Railway Company, 3 per cent Debenture Stock, purchased at		611 10 6
		£6,761 10 6
BALANCES in Royal Bank—		
On Deposit Receipt, dated 3rd February 1898	£100 0 0	
On Current Account	311 13 2	
		411 13 2
		£7,173 3 8
II. INCOME—		
1 Interest on Investments—		
On £3,193, 6s. 8d. 3 per cent Debenture Stock of the North British Railway Company, £95, 16s., less tax £5, 5s. 6d.	£90 10 6	
On £3,500 on Loan over the Earl of Minto's Estates at 3 per cent, £105, less tax £5, 15s. 8d.	99 4 4	
On £550 Lancashire and Yorkshire Railway Company 3 per cent Debenture Stock, £16, 10s.; less tax 17s. 2d. . . .	15 12 10	
		205 7 8
SUM OF CHARGE . . .		£7,378 11 4

ARGYLL NAVAL FUND for Year 1900-1901.

DISCHARGE.

I. ALLOWANCES to the five following Recipients—				
Edward L. Grieve (seventh year)				£40 0 0
Percy L. H. Noble (seventh year)				40 0 0
Malcolm H. S. Macdonald (fifth year)				40 0 0
James Douglas Campbell (third year)				40 0 0
John Stewart Gordon Fraser (third year) . . .				40 0 0
				£200 0 0
II. FUNDS as at 30th November 1901—				
£3,193, 6s. 8d. 3 per cent Debenture Stock of the North British Railway Company, purchased at		£2,650 0 0		
Amount on Loan over the Earl of Minto's Estates, at 3 per cent		3,500 0 0		
£550 Lancashire and Yorkshire Railway Company 3 per cent Debenture Stock, purchased at		611 10 6		
		£6,761 10 6		
Balances in Royal Bank—				
On Deposit Receipt, dated 3rd February 1898 . .	£100 0 0			
On Deposit Receipt, dated 5th December 1900 . .	100 0 0			
On Current Account . .	217 0 10			
		417 0 10		
				7,178 11 4
SUM OF DISCHARGE . .				£7,378 11 4

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILMOUR, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 8*th January* 1902.

PROCEEDINGS AT BOARD MEETINGS.

MEETING OF DIRECTORS, 6TH FEBRUARY 1901.

Present.—Ordinary Directors—Mr Alexander Cross of Knockdon; Mr W. T. Malcolm, Dunmore Home Farm; Mr Jonathan Middleton, Clay of Allan; Mr E. Hedley Smith, B.L., Whittinghame; Sir Alan H. Seton-Steuart of Touch, Bart.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr R. W. B. Jardine, yr. of Castlemilk; Mr A. M. Gordon of Newton; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Mr John Marr, Cairnbrogie; Rev. John Gillespie, LL.D., Mouswald Manse; Mr C. H. Scott Plummer of Sunderland Hall; Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr John Macpherson Grant, yr. of Ballindalloch; and Mr John Wilson, Chapelhill. *Extraordinary Directors*—Mr Andrew Mackenzie of Dalmore; Mr John M. Martin, Edinburgh; Mr Andrew Hutcheson, Beechwood; Mr Wellwood Maxwell of Kirkennan; Sir Ralph Anstruther of Balcaskie, Bart.; Mr George R. Glendinning, Hatton Mains; Mr John Cran, Kirkton; and Sir Robert Menzies of Menzies, Bart. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Chemist*—Dr A. P. Aitken. Mr A. M. Gordon in the chair.

THE LATE QUEEN VICTORIA.

The CHAIRMAN, before beginning the business of the meeting, referred in fitting terms to the loss sustained by the country and the Society by the death of her Majesty the Queen. An address to be presented to the King, prepared by Mr Macdonald, was read and adopted. The text of the address appears on p. 9 of the vol. of 'Transactions' for 1901, Fifth Series, vol xiii.

INVERNESS SHOW, 1901.—AYRSHIRE QUEYS

Mr MARTIN, with reference to the rules and schedule of prizes for the Inverness Show, drew attention to rule 36, which he said did not meet the idea of the Board in regard to Ayrshires. Ayrshire heifers—two years old—were not included in the rule reading "Two-year-old heifers of the Shorthorn, Aberdeen-Angus, and Galloway breeds and three-year-old Highland heifers must be in calf when exhibited, and the premiums will be withheld till birth be certified, which must be within nine months after the Show." The in-calf regulation was passed by the Board with the intention of not encouraging the keeping of a heifer between two and three years old without breeding from. Now, he would like to see the Ayrshires brought into a line with the other breeds, and that the breed should be included in the rule.

After some discussion, however, Mr Martin's suggestion was agreed to on the understanding that the heifer might be in milk or calf.

CAWDOR CUP.

A letter was read from Mr MacNeilage, the Secretary of the Clydesdale Horse Society, intimating that the Society had agreed to present another Cawdor Cup for competition at the Shows of the Society, to be won three times by the same exhibitor, each time with a different animal, before becoming his own property.

It was agreed to accept the Cup and thank the Society for it.

Pony Stallions.

The Secretary intimated that Lord Tweedmouth had given, in addition to £20 previously intimated, other £20 as prizes for Highland stallions and ponies. There was £20 for pony stallion, 14·2, best adapted to get ponies out of Highland pony mares suitable for mounted infantry, and it was provided that the stallion which won the prize should serve Highland pony mares in 1902 in the counties of Elgin, Nairn, Inverness, Ross, Sutherland, and Caithness, and at such centres as might be arranged by the Society, at a guinea per mare and a guinea per foal. The other £20 was for Highland-bred ponies, any age, mare or gelding, not exceeding 14·2, suitable for mounted infantry. The term Highland-bred pony is to mean ponies bred in one or other of the counties of Argyll, Perth, Forfar, Kincardine, Aberdeen, Banff, Elgin, Nairn, Inverness, Ross and Cromarty, Sutherland, Caithness, and Orkney and Shetland.

Mr Wilson asked if it was desirable that they should make a distinction by counties in which the ponies were bred. They did not wish to discourage the breeding of ponies in other counties. He thought the type of pony would be a better criterion.

The Secretary said that he had communicated with Lord Tweedmouth on the subject, and the definition was that suggested by him. It was very difficult to describe the type of pony.

The matter then dropped.

Hunter Classes.

Mr John Macpherson Grant intimated that Mr Charles D. Stewart of Brin offered a prize of £10 for the best colt or gelding, one, two, or three years old, in the Hunter classes, and this was accepted with thanks.

Wethers.

Mr Christie said that sheep-breeders viewed with considerable disappointment the deletion of the classes for Blackface and Cheviot wethers, and he moved that they be reinstated as at Stirling.

The Secretary pointed out that the point had been discussed very fully by the Shows Committee, and they had before them a statement of the entries for a good many years back. In view of the small number of entries, which were practically from the same exhibitors, the Committee recommended the Board to drop them for a time, and that was unanimously agreed to. The classes were very successful for a time.

The Chairman ruled the matter could not be reopened at this date.

Aberdeen Show, 1902.

Mr Marr moved that the Aberdeen Show of 1902 be held in the fourth week of July. It would be in the recollection of all the members of the Board that for a long time the date of the Highland Show always was the fourth week of July, and he thought, taking the average of the entries over the various localities for all Scotland, that this date was more suitable to agriculturists in general, and more calculated to conduce towards a successful show than any other date. But a special circumstance arose which overbalanced those other considerations. That was that by putting the date forward they might have Royalty to countenance their Show. He quite admitted that the change was fully warranted in these circumstances. He proposed this reversion to the former date on the assumption that it was quite as convenient for Royalty to attend the Show at that time as on any other date. However, if they got the King or any other member of the Royal Family to attend this Show, they should certainly try and suit their convenience, but he thought the fourth week was the most suitable for the general agriculturists of Scotland.

Mr Malcolm seconded Mr Marr's motion.

Dr Gillespie said he would like to know what was the date of the Royal Northern Show. He understood that it was the second or third week.

Mr Marr said that the date of the Royal Northern used to be the week preceding the Highland Show before the latter altered its date. When it did so it had been found an improvement to take another date.

Dr Gillespie. But never as late as the fourth week.

Mr Marr. Yes.

The Secretary pointed out that one reason for having a fixed date was that complaints were made by other societies which desired to keep clear of the Highland

week, and it was a great advantage to the Highland and to other societies to make known their date early.

Dr GILLESPIE moved that, subject to any unforeseen circumstances arising, they hold the Show on the third week of July. He thought the Royal Northern date was entirely against Mr Marr's motion. Then it was a change from their usual practice, and he did not see why they should change for Aberdeen or any other place. The question of the date of the Show was very widely discussed, and the unanimous recommendation of the district meetings was that it should be held on the third week. (Mr Marr. "Never.") That was his strong impression. Again, the Great Yorkshire Society had resolved to have their show on the fourth week for the express purpose of not clashing with the Highland Show; and it would not be right, knowing this, that they should move back to the week they had selected. There was no hope of getting Royalty to patronise their Show on the fourth week, as they had been engaged from time immemorial on that week elsewhere.

The SECRETARY stated that the districts had very largely supported the third week.

On a vote being taken, Mr Marr's motion was lost by 8 votes to 17 for Dr Gillespie's amendment.

DUMFRIES SHOW, 1903.

The local Directors were appointed a committee to arrange for a site for the Dumfries Show of 1903, and for the raising of the local fund.

FORESTRY.

It was remitted from the anniversary general meeting on the 9th January for the Directors (1) to endeavour to arrange for a forestry display at the Glasgow Exhibition, and (2) to consider the propriety of having a forestry exhibit at the annual shows of the Society.

The SECRETARY said, with reference to the first part of the motion, that since the general meeting he was present at a meeting in Glasgow of the committee in charge of that branch of the Exhibition, and apart altogether from the question of space and expense it had been found that it would now be quite impossible to arrange anything like a satisfactory forestry exhibit in the time, and therefore it was impracticable to carry out the suggestion. With reference to the other part of the motion, they had learned from the Royal Scottish Arboricultural Society that that Society would be willing to confer with the Board as to an exhibit at the Highland Show.

Sir ROBERT MENZIES said that shortly after the Board had approached the Exhibition authorities on the subject, and been refused on account of want of space for an exhibition, the Exhibition authorities had approached the Arboricultural Society, and he thought they were entitled to ask why they had been left out, and they the original movers in the matter.

VETERINARY ADVISER.

It was remitted to the Finance Committee to consider and report as to the advisability of filling up the office of Veterinary Adviser to the Society, rendered vacant by the death of Principal Williams.

SCIENCE COMMITTEE.

The SECRETARY reported that the Science Committee had met and revised the tables of the units and values of manures and feeding-stuffs, and recommended that the schedule as now adjusted should be circulated among the members. An arrangement as to an investigation regarding tuberculosis in cattle had been entered into some time ago with the Agricultural Department of Aberdeen University, but owing to absence of the veterinary surgeon in South Africa nothing had been done. Mr Young has now returned, and it was understood that the investigation would be undertaken this year. The investigation into the matter of milk from tubercular cows could not be completed owing to the death of Principal Williams. A large number of samples of milk from reacting cows had been collected and examined by the late Principal Williams, but no conclusion had been come to. The Committee thought that the investigation should be continued, and having in view the circumstances of the Aberdeen experiment, they recommended that they receive power to arrange with the Agricultural Department of Aberdeen University to make the inquiries, and suggested that a sum not exceeding £50 and a part of what has been already voted might be placed at their disposal for this purpose.

Mr D. WILSON, seconded by Mr HUTCHESON, moved the adoption of the Committee's report, which was agreed to.

Agricultural Education Conference.

A Committee was appointed to attend a conference in Edinburgh on Saturday, 2nd March, at 1.30 P.M., regarding the promotion of agricultural education and research in the south-east of Scotland.

Hour of Meeting.

Sir Robert Moncreiffe gave notice that at next meeting he would move that the hour of meeting be changed from 1.30 to 2.15 P.M.

Dr Gillespie. I beg to give notice that I will move an amendment.

This was all the business.

MEETING OF DIRECTORS, 6th MARCH 1901.

Present.—Ordinary Directors—Mr Alex. Cross of Knockdon; Mr W. T. Malcolm, Dunmore Home Farm; Mr William Duthie, Tarves; Mr John M'Caig, Challoch; Mr Jonathan Middleton, Clay of Allan; Mr E. Hedley Smith, B.L., Whitinghame; Mr William Clark, Netherlea; Sir Alan H. Seton-Steuart of Touch, Bart.; Mr R. Shirra Gibb, Boon; Mr R. W. B. Jardine, yr. of Castlemilk; Mr Alex. M. Gordon of Newton; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Rev. John Gillespie, LL.D., Mouswald Manse; Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr Robert F. Dudgeon of Cargen; and Mr John Wilson, Chapelhill. *Extraordinary Directors*—Mr George Inglis of Newmore; Mr J. Lyon Guild, Strowan; Mr Andrew Hutcheson, Beechwood; Mr Wellwood Maxwell of Kirkennan; Sir Ralph Anstruther of Balcaskie, Bart.; Mr John Cran, Kirkton; Mr Walter Elliot, Hollybush; and Sir Robert Menzies of Menzies, Bart. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. Mr Alexander M. Gordon of Newton in the chair.

Inverness Show, 1901.—Easter Ross Club Donation.

The Secretary intimated that he had received a letter from the Secretary of the Easter Ross Farmer Club, in which it was stated that the club had agreed to have no show this year owing to the visit of the Highland to Inverness, and to give a donation of £40 to the local fund.

The Chairman moved that the Secretary be requested to return to the Easter Ross Farmer Club their grateful thanks for their patriotic action. He thought the whole of the Inverness district deserved the greatest credit for the way in which they had promoted the interests of the Society.

Agreed.

Concert for Attendants.

It was left to Mr Ferguson and the Secretary to arrange for the attendants' concert at the Show.

Shetland Ponies.

The Secretary explained that with reference to the classes for Shetland ponies at the Inverness Show he had had a letter from the secretary of the Shetland Pony Society, pointing out that the conditions of exhibition were not what they expected. The conditions had been drawn up in accordance with a letter from Mr Fletcher, president of the society, but he had made a mistake, with the result that two-year-old ponies were not allowed to compete. The Shetland Pony Society pointed out that there was no intention on their part to alter the ages, and they asked that the mistake be remedied.

This was agreed to.

Hour of Meeting.

Sir Robert Moncreiffe, Bart., had given notice that he would move—"That the Board meeting in future be held at 2.15 P.M. instead of 1.30 P.M. as at present." He

was not present, but had written asking the Board to be good enough to allow this matter to stand over till a future meeting. Several members pointed out that some were there specially that day to vote in the matter, and as it might not be convenient for them to come next time it was brought up, they wanted to have the matter settled.

Mr INGLIS moved the motion, and Mr D. WILSON seconded, with the object of having the matter disposed of.

Dr GILLESPIE, in moving the previous question, said that the present rule had worked very well indeed, as every one of them could testify from experience in the past. They had to consider not only the meetings of the Board but the meetings of committees which prepared the work for the Board. Many of them to attend the committee meetings had to come to Edinburgh the night before. At least that was his experience, and the change would necessitate in many cases their not only coming on the Tuesday night, but their staying over the Wednesday night, and that was longer than they could afford time or money for. Instead of the change being a convenience it would be an inconvenience.

Mr HUTCHESON seconded.

Dr Gillespie's amendment was carried by 23 votes to 3.

DENTITION OF FARM STOCK.

A letter was read from Principal Owen Williams asking the Society to assist him in obtaining information regarding the dentition of farm live-stock. He intended issuing a book to stock-breeders in which they could note down the state of the teeth of animals monthly from three months to three years of age.

A letter was also read from Mr Ferguson, saying that he hoped the Board would do nothing in regard to the request. Every practical farmer knew about the dentition of farm stock. If it had been proposed to enable one to know the age of a horse after he had passed his seventh or eighth year of age it would be of some good.

The SECRETARY said that Principal Williams' idea was that the books should be given to the cattlemen, who would examine the mouths of the cattle and write in a statement in regard to the condition of the teeth.

Mr DUTHIE moved that the Directors do nothing in this matter. He was a judge at the Smithfield Show when this matter was before the club, and a good deal of friction arose over it. He did not think they would get cattlemen throughout the country to take the trouble, and even if they did, he doubted if the evidence would be of such a reliable nature as required by a Society like theirs.

Mr CRAN seconded, and the motion was agreed to.

THE BABCOCK TEST.

Mr JOHN M'CAIG moved the following motion which stood in his name: "That it is desirable that the Babcock test should be officially recognised as a standard measure of the quantity of butter-fat in milk, and as such brought within the provision of the Weights and Measures Acts, and that the Board of Directors take such steps as may seem to them advisable for the attainment of this object." He said that it would be in the recollection of the members of the Board that he brought forward a motion asking that the Board of Agriculture should stamp the glasses, &c., used for the Babcock test. Those who were present at last meeting would have heard a communication read from the secretary to the Board of Agriculture saying that they had carried out the requirements asked for. It was within his knowledge that the Board of Agriculture had had very considerable difficulty in giving effect to what the Directors asked. They had erected premises, and had been at a considerable amount of trouble and expense and he felt that they would be doing less than their duty now if they did not accord a very hearty vote of thanks to the Board of Agriculture for the interest which they were taking in this matter. The society which he represented asked him to tender their most hearty thanks to the Society for the interest they had taken in the matter, and to Mr Macdonald for the ready assistance and wise counsel he had given them in carrying their point. When the matter was taken in hand a little over a year ago their friends laughed at the idea of their being able to move the Board of Agriculture to stamp the measures. To-day that was being carried out for any one who would be at the trouble to send the articles up. The society which had asked him to bring the matter forward had about 140 members. The milk of something like 10,000 cows was their property. As regards the selling of milk to the creameries, he might mention that it was sold at so much per gallon, which must contain a certain amount of butter-fat, and the Babcock test was used by the creameries to ascertain the amount of fat. It was quite well known that the bottles, measures, or glasses might or might not be correct, and there was no official method of knowing whether they were correct or not. Thus the milk-sellers wished the Babcock test, which was

really the final arbiter in the price of milk, brought under the scope of the Weights and Measures Act, because it might make a difference of 1d. or ½d. per gallon whether the test vessels were correct or incorrect. Some creameries bought as much as 9000 gallons a-day in the height of the season, and they would thus see the need of official verification of the measures. Now, it was not his intention that this matter should be rushed in any way. His former motion had been submitted to the Science Committee before this Board would commit themselves to any particular test. There were other tests, and he would not like that that Board should commit itself by asking the Board of Agriculture to accept the Babcock test as the efficient test over all others, and he would ask that the motion be submitted to the Science Committee for fuller discussion before the Board was committed in any way. Of course there were many who did not require that the stamping should be compulsory before they would do anything. He wished to dissociate himself entirely from the idea that there were; because he knew of two creameries which had sent up their spare measures to be stamped, and would send up the others in due course. Of course there might be other creamery companies for which law of some kind was necessary. He begged to move that the matter be remitted to the Science Committee.

Dr Gillespie seconded, and complimented Mr M'Caig on the knowledge, fairness, and moderation with which he had moved in the matter.

The motion was unanimously agreed to.

Joint Board of Agricultural Education.

A letter was submitted from Mr G. R. Glendinning intimating his resignation as one of the Society's representatives on the Board of Management of the Edinburgh School of Rural Economy, and on the motion of Mr D. Wilson, seconded by Mr Middleton, Mr Martin was appointed in his stead.

Dairy Conference.

The Secretary explained that the annual conference of the British Dairy Farmers' Association would be held in Scotland in the beginning of June, and that it was probable that a conference might be held in Edinburgh on the 8th June. He asked if he might offer the Association the use of the Society's rooms.

This was unanimously agreed to, and Mr M'Hutchen Dobbie, Sir James Gibson-Craig, and Mr Martin were appointed a committee of the Society to consider arrangements for the conference.

Forestry.

The Secretary stated that the Committee appointed at last meeting to consider the suggestion which came from the general meeting of the members to have a forestry exhibition at the Inverness Show had had a meeting that day with a deputation of the Royal Scottish Arboricultural Society. The deputation said that they would prepare and make arrangements for the exhibition, and take away the exhibits at the finish of the Show if the Society would provide space and an erection in the yard free of expense, and the Committee now recommended the Board to adopt this course.

Sir Robert Menzies moved the adoption of the report, and in doing so referred to the poor support given to forestry in this country. They spent twenty millions on wood from abroad which they might furnish themselves, and they could supply as good timber in Scotland as foreigners could. It was discussed as to whether they should admit foreign timber into the exhibition, and he suggested that they should, as they would then have a chance of comparing its quality with that of the home-grown article.

The motion was agreed to.

Veterinary Adviser.

The Committee appointed to consider the expediency of appointing a veterinary adviser to the Board recommended that no appointment be made at present, but that the Board appoint veterinary surgeons to discharge veterinary surgeons' duties as these arise.

This was agreed to.

Secretary's Salary.

The Board then sat in private to consider notice of motion by the Chairman—"That in view of the satisfactory financial position of the Society, which is so greatly due to the energy and ability of our Secretary, the time has come to reconsider the question of his remuneration; and that a small committee, consisting of the Chairman of the Board, Chairman of Finance Committee, and the Convener of the Committee appointed

in 1892 to arrange the conditions of the office of Secretary, and a representative of each show district, be appointed to consider the question and report to the Board at a future meeting.

The motion was unanimously agreed to, and the Committee appointed.

MEETING OF DIRECTORS, 3RD APRIL 1901.

Present.—Ordinary Directors—Mr Alexander Cross of Knockdon ; Mr W. T. Malcolm, Dunmore Home Farm ; Mr William Duthie, Tarves ; Mr Jonathan Middleton, Clay of Allan ; The Hon. the Master of Polwarth, Humbie House ; Mr E. Hedley Smith, B.L., Whittinghame ; Sir Alan H. Seton-Steuart of Touch, Bart. ; Mr W. S. Ferguson, Pictstonhill ; Mr R. Shirra Gibb, Boon ; Mr Alexander M. Gordon of Newton ; Sir Archibald Buchan Hepburn of Smeaton, Bart. ; Rev. John Gillespie, LL.D., Mouswald Manse ; Mr C. M. Cameron, Balnakyle ; Mr C. H. Scott Plummer of Sunderland Hall ; Mr John M'Hutchen Dobbie, Campend ; and Mr John Wilson, Chapelhill. *Extraordinary Directors*—Mr J. Lyon Guild, Strowan ; Mr John M. Martin, Edinburgh ; Mr Andrew Hutcheson, Beechwood ; Sir Ralph Anstruther of Balcaskie, Bart. ; Mr John Cran, Kirkton ; Mr Robert Paterson, Hill of Drip ; Mr Walter Elliot, Hollybush ; and Sir Robert Menzies of Menzies, Bart. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. Mr A. M. Gordon in the chair.

INVERNESS SHOW, 1901.

It was agreed to accept contracts for catering from Messrs J. Hay, Aberdeen ; J. Brodie, Dalkeith ; Whyte & Smith, Glasgow ; Wilson & M'Phee, Glasgow ; and the local branch of the British Women's Temperance Association.

LOCAL FUND.

Intimation was made of the following contributions to the local fund : (1) £20 by the Duke of Fife ; (2) £25 by Mr Walter Shoolbred of Wyvis ; and (3) £25 by the Wester Ross Farmer Club.

Dr GILLESPIE said that as one of those who had some doubt about going to Inverness, he wished to say that their northern neighbours had far exceeded their expectations in the contributions they had made to the funds of the Society. They had risen to the occasion in a way that was beyond praise, and there was no fear that the Society would ever refuse to go to Inverness when they did so.

On the motion of the CHAIRMAN the donors were thanked.

TRIAL OF BINDERS.

On the motion of Mr JONATHAN MIDDLETON it was agreed to have an exhibition of binders at work in a field near Inverness early in harvest ; and it was remitted to the implement stewards to make the necessary arrangements.

AGRICULTURAL SEEDS.

Mr JOHN M. MARTIN, in terms of notice of motion, moved—"That it be remitted to a committee to consider the report of the Departmental Committee on Agricultural seeds, and advise as to what steps, if any, the Directors should take in regard to the matter." It was unnecessary, he said, to say anything in support of the motion, as he did not suppose anybody would oppose it. He wished to emphasise the value of the services rendered by Mr Speir in the evidence he had given to the Committee on their behalf, and by Mr D. Wilson, who had sat on the Committee.

Mr ALEX. CROSS of Knockdon seconded, and the motion was agreed to.

A committee was appointed, with Mr D. Wilson as convener.

IMPLEMENTS AT INVERNESS.

The SECRETARY read the minutes of meeting of the Implement Committee held that day. A conference had taken place between the Committee and representatives of the Scottish Implement-Makers' Association, and in deference to their strongly ex-

pressed wish it was agreed not to give any awards for implements or to have competitive trials of such.

The Committee then invited the views of the representatives of implement-makers upon the proposed alterations regarding the implement section of the Society's Show as dealt with in the report of the Committee, dated 7th November 1900. A friendly conference followed, in the course of which it was learned that the Scottish Implement-Makers' Association approved of the suggestion that the extent of the implement-yard should be lessened, but objected to an increase in the charges for space. The deputation having withdrawn, the Committee took into consideration the course, which in view of the statements submitted by the deputation, it would be expedient for the Society to adopt. The Committee adhere to the statements in the report of Committee already referred to (dated 7th November 1900) as to the advantages to be gained by all parties interested from the suggested lessening and rearranging of the implement-yard, but they feel that, with due regard to the different interests involved, they cannot recommend the Society to impose a fixed artificial restriction to the extent of implement space without a slight increase in certain of the rates charged to exhibitors. The Committee think well to point out that the proposed scheme of alterations in the implement section was prepared, not in the financial interests of the Society, but mainly in the interests of the sellers and the buyers of improved agricultural machines and implements. It was intended that the scheme would be so worked as that the Society would draw not more, but less, money than hitherto from implement exhibitors, and yet that exhibitors of implements would be enabled, for less outlay to themselves, to do more actual business in the showyard, and derive more indirect benefit from their appearance there, than they can secure under existing circumstances. To the general body of agriculturists who visit the Show the advantage would be that the lesser area and improved arrangement of the implement-yard would enable them to inspect the implement exhibits with greater ease and comfort, and thus no doubt induce them to make more purchases than could be looked for from a less complete and more fatiguing inspection. The Committee, however, feel that without the hearty co-operation of implement exhibitors the scheme might not successfully promote the main objects sought to be served, and therefore, in view of the opposition of the Scottish Implement-Makers' Association, the Committee recommend that the scheme be dropped.

This report was adopted.

Office-Bearers and Directors.

A committee consisting of Mr A. M. Gordon (Convener), Sir John Gilmour, Mr Scott Plummer, Mr Shirra Gibb, Mr Hedley Smith, Mr Dudgeon, Mr J. Marr, Sir James H. Gibson-Craig, Mr Clark, Rev. Dr Gillespie, Mr J. D. Fletcher, Mr Cameron, and Mr Duff of Drummuir, was appointed to prepare a list for 1901-1902 of Office-Bearers and Directors.

Secretary's Salary.

The Directors then sat in private to consider the question of increasing the Secretary's salary, when it was unanimously agreed to advance Mr Macdonald's salary by £200 per annum.

MEETING OF DIRECTORS, 1st MAY 1901.

Present.—Ordinary Directors—Mr W. T. Malcolm, Dunmore Home Farm; Mr John M'Caig, Challoch; Mr Jonathan Middleton, Clay of Allan; Mr E. Hedley Smith, B.L., Whittinghame; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr Alex. M. Gordon of Newton; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Rev. John Gillespie, LL.D., Mouswald Manse; Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr John Macpherson Grant, yr. of Ballindalloch; and Mr John Wilson, Chapelhill. *Extraordinary Directors*—Mr George Inglis of Newmore; Mr G. R. Mackessack of Adgye; Mr Andrew Hutcheson, Beechwood; Mr John Cran, Kirkton; Sir Robert Menzies of Menzies, Bart.; and Mr John Speir, Newton Farm. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. Mr A. M. Gordon in the chair.

Death of Mr Lockhart.

The Chairman moved that the Society record in their minutes an expression of sorrow at the loss sustained by the Society in the sudden and unexpected death of Mr James Lockhart, Mains of Airies. He had acted on behalf of the Society in a most acceptable way as a Director and member of Committees for very many years. He was a most useful member.

The motion was agreed to.

Inverness Show, 1901.

A donation of £20 to the local fund was intimated from Earl Cawdor, and this was accepted with thanks.

Attending Members.

The attending members from among the Directors were appointed to the various classes.

Local Committees.

The Secretary intimated that the local Directors had held a meeting, and had appointed a local committee.

Petty Customs.

A letter was read from the Town Clerk of Inverness intimating that Petty Customs will not be charged on exhibits passing through the town of Inverness to and from the Show.

Highland Club.

A letter was received from the Secretary of the Highland Club, Inverness, offering to the Directors and members of the Local Committee the use of the club as honorary members during the time they are in Inverness attending the Show, and it was agreed to convey the thanks of the Directors for this privilege.

Prizes for Fat Wethers.

The Secretary read letters from Mr Shepherd, Secretary of the Windygates Agricultural Society, and Mr Watt, Secretary of the Cupar and North of Fife Agricultural Society, against the discontinuance of prizes for fat wethers.

Mr Christie said he had called the attention of the Board to the deletion of those classes at the meeting of 6th February. The action of the Board had caused a good deal of disappointment amongst intending exhibitors who were preparing their stock for the Inverness exhibition. He had met a number of them, and they expressed their disappointment.

The Chairman, interrupting, pointed out that no motion was competent, and all he could accept would be a motion to refer the matter to the Shows Committee to deal with next year.

Mr Christie said that he did not wish to bring forward a motion, but he wished to let the Directors understand that there was considerable disappointment felt at the doing away with the classes.

Rev. Dr Gillespie moved that the matter be referred to the Shows Committee to consider in connection with the Aberdeen Show. In reply to Mr Christie's remarks, he would point out that the class for wethers was instituted some twelve or fifteen years ago, and they had made a great advance in early maturity since then. In fact, so great had been the advance that he thought a class for wethers of that age might be dispensed with if they were to keep up with the times. Taking the last year's Show at Stirling, there were three classes for wethers, and in one of them there were four entries, three exhibitors in another, two entries by two exhibitors, and in the third six entries by three exhibitors. There were thus only eight exhibitors in the three classes.

Dr Gillespie's motion was agreed to.

Parades.

The parade stewards recommended that the hours of the parades and the charges be the same as last year, and this was adopted.

Dumfries Show, 1903.

A letter was submitted from the county clerk of Dumfries intimating that his finance committee had resolved to recommend the county council to raise in aid of

the Highland Show of 1903 a sum of about £940 by means of a voluntary assessment of ½d. per £, as was done for the Show of 1895.

The SECRETARY stated that the other two counties were immediately to consider the subject of raising contributions.

The question of a site for the Show was considered in private.

MANURING GRAZING-LAND.

The SECRETARY submitted a letter from the Board of Agriculture intimating that the Board approves of the arrangements for the experiments in the manuring of grazing-land to be carried out jointly by the Society and the Board of Agriculture, and that, subject to the favourable report of their inspector, the Board would be prepared to make a grant in aid of the experiments thus conducted, amounting to £125 in the first year, and £75 for each of such subsequent years in which the experiments may be continued.

The SECRETARY stated that it had been remitted to a sub-committee of the Science Committee to carry out this experiment, and they had met that day and made arrangements for furthering the work.

TUBERCULOSIS CONGRESS.

An invitation was submitted to the Society to send delegates to the British Congress on Tuberculosis to be held in London in the last week of July, and a subscription list was enclosed. It was agreed to give a donation of £20 towards the expenses of the Congress, and Mr R. Shirra Gibb was delegated to attend it.

SPARKS FROM RAILWAY ENGINES.

The SECRETARY submitted a report from the Secretary to Mr Munro Ferguson, M.P., upon an outbreak of fire on a plantation on the Raith estate, stated to have been caused by sparks from a passing railway engine. He (the Secretary) assumed that this report had reference to the Sparks from Railway Engines Bill, which was at present before Parliament, and which was backed by Mr Munro Ferguson and others.

Mr MACKESSACK said that this bill had passed its second reading in the House of Commons by a large majority, and he thought it was a most important measure as regards agriculturists in the North. He himself had suffered on more than one occasion, and when he applied to the railway company managers for redress he was told that the engines were provided with proper appliances for preventing sparks. It was not for him, as a private individual, to fight the railway company. Whether they had money or not to pay shareholders' dividends they had always money to go to law. He even had had stooks set on fire by sparks from railway engines. The bill was a very moderate one, as all that it wanted was to make the same law apply to railway engines as was at present applicable to traction engines. If a traction engine set fire to a house or other property, the owner was liable for the damage. He thought this was a matter that should be taken up by the Society, and that they should petition in favour of the bill.

Sir ROBERT MONCREIFFE seconded, and the motion was agreed to.

EAST OF SCOTLAND AGRICULTURAL COLLEGE.

The SECRETARY intimated that the Education Department had approved of the scheme drawn up for establishing a College of Agriculture for the South-east of Scotland, and the Society was entitled to nominate two gentlemen on the Board of Management. The scheme was practically the same as that for the institution of the West of Scotland College.

Mr Macdonald, the Secretary, and Mr Shirra Gibb were appointed.

WILLIAMS' MEMORIAL.

Subscription sheets were submitted from the Secretary to Principal Williams' Memorial, but it was pointed out that the Board were not in a position to subscribe as a Board.

AGRICULTURAL SEEDS.

The Committee appointed to consider the recommendation of the Departmental Committee on Agricultural Seeds had met that day, and recommended that the Directors cordially approve of the paragraph recommending the institution of a seed-testing station at one centre under Government auspices; and further, they recommended that the Directors urge the Board of Agriculture to take steps to establish such a station.

Mr FERGUSON, in moving the adoption of the report, said that, although he did not agree with several things mentioned in the report, they were all agreed that every facility should be given farmers and merchants to test their seeds, and be able thus to buy to better advantage. They thought that one station would be sufficient.

Mr R. SHIRRA GIBB seconded the motion, as he thought the report was on the right lines. He thought one station would meet all wants.

Agreed.

PUBLICATIONS.

The SECRETARY reported that the Publications Committee had met and voted fees to writers of articles in the 'Transactions.' The total amount was £120, or a little less than last year. It would be a great help to the Committee if members would submit suggestions as to suitable subjects for papers in the 'Transactions.'

Dr GILLESPIE, as Convener of the Committee, laid on the table the volume of the 'Transactions.' He thought they would bear him out in saying that it was a very satisfactory work, and should prove a useful one. They were greatly indebted to the Secretary for the able way in which the work in connection with it was conducted.

DISEASE IN SWEDES.

Dr R. S. MACDOUGALL, in his report on the mysterious disease which attacked the swedish turnips last year, reported as to what had been done. No conclusion had been arrived at, and those who noticed the disease this season were asked to at once communicate with the Secretary.

THE BABCOCK TEST.

The Committee to whom it was remitted to consider as to the advisability of having the stamping of measures used in connection with the Babcock test for milk brought under the scope of the Weights and Measures Acts recommended that the Secretary be instructed to communicate with the Board of Agriculture on the matter.

This was agreed to.

FORESTRY EXAMINATION.

It was reported that five candidates sat for the forestry examination. One obtained the higher certificate, three the second, and one failed. The next examination is to be held in 1903.

GENERAL MEETING.

It was agreed to hold the next monthly meeting and the general meeting both on the 5th June.

MEETING OF DIRECTORS, 5TH JUNE 1901.

Present.—Ordinary Directors—Mr Alex. Cross of Knockdon; Mr W. T. Malcolm, Dunmore Home Farm; Mr Jonathan Middleton, Clay of Allan; Mr E. Hedley Smith, B.L., Whittinghame; Mr William Clark, Netherlea; Mr R. Shirra Gibb, Boon; Mr Alex. M. Gordon of Newton; Mr R. Sinclair Scott, Burnside; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Rev. John Gillespie, LL.D., Mouswald Manse; Mr C. M. Cameron, Balnakyle; Mr Wm. Taylor, Park Mains; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; and Mr John Wilson, Chapelhill. *Extraordinary Directors*—Mr George Inglis of Newmore; Mr G. R. Mackessack of Ardgye; Mr R. Trotter, Garguston; Mr J. Lyon Guild, Strowan; Mr John M. Martin, Edinburgh; Mr Andrew Hutcheson, Beechwood; Mr George R. Glendinning, Hatton Mains; Mr John Cran, Kirkton; Mr Robert Paterson, Hill of Drip; and Sir Robert Menzies of Menzies, Bart. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Hon. Secretary*—Sir John Gilmour of Montrave, Bart. Mr Alexander M. Gordon of Newton occupied the chair.

The CHAIRMAN referred in sympathetic terms to the death of Sir Graham Montgomery, Bart., and a minute of condolence was drawn up to be forwarded to his relatives.

The minutes of meeting of 1st May were approved.

INVERNESS SHOW.

Subscriptions to the local fund were intimated of £25 from Mr George Bullough of Rum, and £20 from the Nairnshire Farming Society.

In answer to a letter from the manager of the Highland Railway, who offered to run cheap evening excursions from certain towns to the north and east of Inverness, it was agreed that the showyard would be open on the Thursday evening from 5 to 9 P.M. at a popular admission fee of 1s., and jumping competitions would be provided for that evening.

DUMFRIES SHOW, 1903.

Favourable reports were submitted regarding this Show, the success of which was already secured, as the three counties of Dumfries, Kirkcudbright, and Wigtown have agreed to levy a voluntary assessment, and the town of Dumfries is to make the same contribution and render the same assistance as it did in 1895.

BABCOCK AND OTHER TESTERS.

A communication was read from the Board of Agriculture intimating that the arrangements made for testing the Babcock test would apply generally to appliances used in other similar milk tests, but that the Board of Trade advises that the Weights and Measures Act of 1889 does not give power to make a new denomination of standard fixing the quality as well as the quantity of any commodity sold.

Dr GILLESPIE said he hoped those connected with dairying would keep this before them, and make use of whatever opportunity offered for getting the advantage of fresh legislation in this direction.

NATIONAL DIPLOMA IN AGRICULTURE.

Dr GILLESPIE reported the results of the recent examinations at Leeds for the National Diploma in Agriculture. He commented on the superior quality of the work done, and the satisfactory improvement in the teaching, as indicated by the work done by those who passed this year, although they failed last year. Mr Hutcheson asked what proportion of those who passed were from the Scottish universities, and the Doctor replied that two out of the five who took the diploma were from the West of Scotland College, while students from north of the Tweed had made a good appearance in the first department.

MALTING QUALITY OF BARLEY.

A letter was read from Mr Hugh Baird, of Messrs Hugh Baird & Sons, Ltd., maltsters, Glasgow, covering the following letter from the Brewers' Association:—

30th May 1901.

GENTLEMEN,—We, the undersigned, desire to bring under your notice the great loss which has been sustained by Scotch farmers owing to the damage done to Scotch barley in the process of threshing. Since the more general use of the travelling mill, the proportion of broken-skinned and bruised corns has largely increased. Such damage seriously affects the value of the barley for malting purposes, and in many cases samples have been rendered quite unfit for making into brewers' malt. When barley, which has been injured in the above way, is put through the process of malting, mould generates very rapidly, while many of the corns are so injured that they will not germinate at all. Barley of heavy bushel-weight is no longer sought for, and therefore there is no advantage in close dressing. By exercising careful supervision at time of threshing, seeing that the mill is not driven too rapidly, and that the hummeller is not too closely set, farmers would obtain for barley threshed with care a better price, which would amply repay them for any trouble or extra time expended over the process of threshing. The injury to Scotch barley by over-dressing in threshing has necessitated the importation of heavy foreign barleys in considerable quantity, thus displacing home grain to a great extent.—Yours truly,

For Edinburgh Brewers' Association,

T. L. USHER, *Hon. Secy.*

Mr ANDREW HUTCHESON called attention to the great importance of this question. Many of those who had looked at it had thrown aside the hummellers on the mills altogether.

Mr J. LYON GUILD, Inverness, desired to impress the Directors with the importance of the foregoing communication. There was nothing more detrimental to barley

than too close dressing. The broken pickles were the first to mould on the malting-floor, and these very rapidly affected the sound pickles on the floor. As a result the malt had to be put upon the kiln two or three days earlier than would otherwise be the case. When barley was so closely hummelled, as it commonly was, the price was deteriorated to the extent of from 1s. per quarter upwards. It was not now necessary to have such heavy weights per bushel as was once the case, and there was not therefore the same need of close dressing. What was wanted in a good sample was barley free from broken grains; they did not find fault with the tail being on it.

Mr JOHN WILSON thought the farmer was fully alive to the difficulty and loss which he sustained. Whenever he showed a sample with broken grains he was offered a much lower price.

Mr J. M'HUTCHEN DOBBIE maintained that it was not the hummeller but the drum which did the damage, and he thought the Implement Committee should endeavour to consider the matter, and offer premiums for improvements in the drums.

Mr HEDLEY SMITH asked whether the brewers preferred that the grain should not be hummelled at all? He thought the bruising was due to the high-speed drum as much as to anything else.

Mr ROBERT TROTTER thought it would be sufficient to issue a leaflet. If the farmer would keep his drum, whether high speed or low speed, open enough, that was all that was needed. He very soon knew by the price he was offered whether the sample was or was not satisfactory.

Sir ROBERT MONCREIFFE moved, and Mr HUTCHESON seconded, that a committee consisting of the implement stewards, with Messrs M'Hutchen Dobbie, Guild, John Wilson, and Hedley Smith, be appointed to confer with the Brewers' Association on the subject, and this became the finding of the meeting.

MEETING OF DIRECTORS, 6TH NOVEMBER 1901.

Present.—Ordinary Directors—Mr E. Hedley Smith, B.L., Whittinghame; Mr William Clark, Netherlea; Sir Alan H. Seton-Steuart of Touch, Bart.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr Alexander M. Gordon of Newton; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Mr John Marr, Cairnbrogie; Rev. John Gillespie, LL.D., Mouswald Manse; Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr John Wilson, Chapelhill; Mr St Clair Cunningham, Hedderwick Hill; Mr Alex. Cross of Knockdon; Mr A. H. Anderson, Kippendavie; the Earl of Mansfield, Scone Palace; Mr Charles J. Cunningham, Wooden; and Mr John Cran, Kirkton. *Extraordinary Directors*—Mr David Hume, Barrelwell; Mr Robert Paterson, Hill of Drip; Mr Walter Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr John Speir, Newton Farm; Mr Jonathan Middleton, Clay of Allan; and Mr W. T. Malcolm, Dunmore Home Farm. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Honorary Secretary*—Sir John Gilmour of Montrave, Bart. *Chemist*—Dr A. P. Aitken. Mr Gordon of Newton in the chair.

CHAIRMAN, 1901-1902.

The CHAIRMAN said that he desired, before vacating the chair at the termination of two years of office, to tender to each and all of them his most hearty and cordial thanks for the very great consideration and indulgence they had extended to him during his tenure of the chair. He considered that to be elected to that chair was the highest honour that could fall to any agriculturist in Scotland. He had to thank them for the very high honour that they had conferred on him in electing him twice to that high office. Perhaps his reign had not been such a prosperous one as that which fell to the lot of his worthy predecessor, Sir John Gilmour, whose term was so distinguished that he left the office in a halo of glory, with an enormous surplus from the Show that had been held at Edinburgh under royal auspices. But in these last two years he could not say that they had been among the lean kind. The people of Inverness and the North had done everything in their power to facilitate the success of the Show. The Highland capital and the denizens of the Highlands had thoroughly retrieved the reputation of Inverness as a centre for this Show, and he trusted it would be many years before they heard a whisper to the effect that the Show should not be held at Inverness. The district had done remarkably well, in spite of a sin-

gle-lined railway and many natural disadvantages, and he would not, he trusted, be encroaching on their purse-keeper's domains when he told them that the event would result in a small but satisfactory balance. He could not help but think that when everything in this great country had been in an unsettled state it redounded very greatly to the credit of the management of this Society that they should have a considerable sum to invest instead of having a deficit. He begged to thank them for the great courtesy, kindness, and consideration which all had extended to him during his tenure of the chair.

Rev. Dr GILLESPIE moved that they accord a very hearty vote of thanks to Mr Gordon for all his splendid services during the two years which he had presided over that Board. This was not a mere vote of form, but they all appreciated the splendid work he had done for the Society. Not only had he taken a lively interest in their meetings, but day by day and week by week he had kept himself in communication with their Secretary, so that no opportunity would be lost in furthering the interests of this Society.

Sir ROBERT MENZIES did not think a seconder was required, the vote was so unanimous.

The motion was agreed to.

The CHAIRMAN, in reply, thanked them for their vote of thanks. He trusted that his successor would receive the same kindness and consideration at their hands as he himself had experienced, and he hoped he would enjoy such excellent health and freedom from family troubles as he had during his term of office, so that he could also attend every meeting of the Board, and give his attention to the work of the Society.

Mr W. S. FERGUSON moved that Sir Ralph Anstruther be appointed Chairman of the Board for the ensuing year. They had known him as a very capable member of that Board. He gave the affairs of the Society every attention, and they were sure he would be a worthy successor to the worthy men who had gone before him. He was sure the Directors would give him every support.

Mr JOHN MARR seconded, and the motion was agreed to. Sir Ralph not being present, Mr Gordon continued to preside.

The Standing Committees for 1901-1902 were appointed.

INVERNESS SHOW, 1901.

Sir JAMES GIBSON-CRAIG, with reference to the accounts for the Inverness Show, said that the report would be a most satisfactory one. They had not, however, quite adjusted the last details of it, but they would make about £100 out of the Show. They had always looked upon Inverness as a very pleasant place to go to, but not a place at which they could depend on having a surplus, and he was very glad to say that Inverness could now hold its own. This had to a very great extent been due to the liberal subscriptions, which were the second best they ever had. Of course, looking to previous experience with this centre, they kept a bit up their sleeve in case of a deficit, but in consequence of the surplus the Finance Committee had decided to invest another sum of £2000. He moved a special vote of thanks to their friends in the Inverness district.

Dr GILLESPIE seconded. He believed no district in Scotland had done so well as Inverness, not only in subscriptions, but in regard to the large proportion of the people who visited the Show. He would live as long as he could, and he hoped he would never see the day when they would resolve not to go to Inverness.

The motion was agreed to.

THE PROPOSED TRIAL OF BINDERS.

Mr JONATHAN MIDDLETON, as steward of implements, would like to say that a trial of binders was arranged to be held after the Show, but the entries by implement-makers were so small that Mr Macdonald and the stewards did not see it their duty to go on with trials. He must say that he thought it was a sort of slur upon them in the Highlands, when everything that the Society could do was done, that more did not enter. He knew of many farmers in the North who were waiting to see the work done by the various machines before purchasing.

LIST OF AWARDS.

The list of awards at the Show were laid on the table.

A letter was submitted from the Town Clerk of Inverness relieving the Society of any further liability in the restoration of the portion of the Victoria Park on which the Show was held.

Aberdeen Show, 1902.

A statement of the contributions to this Show was made by the Secretary. He said that the counties of Aberdeen, Banff, and the part of Forfar in the Aberdeen district, had agreed to raise sums by voluntary subscription. He had had no indication of any steps having been taken in the county of Kincardine.

The Chairman said that he had had a conversation with the Convener of Kincardineshire, and he said whatever the county would do would be done by private subscription and not by voluntary assessment.

The arrangements for hotel accommodation, catering, police, and music were left in the hands of the Secretary.

Forestry.

A letter was read from the Royal Arboricultural Society asking for space for a forestry exhibition as at Inverness.

Sir Robert Menzies said they showed at Inverness what they could do, and he thought everybody would say that it was a very good exhibition.

The request was agreed to.

Prize-List.

The Secretary reported that at a meeting of the Shows Committee that day the prize-list was gone over and revised, and would be brought up to be dealt with at next meeting, according to custom. The premiums offered would be practically the same as at Inverness last year. The total amount of prize-money would exceed that offered at Aberdeen in 1894 by nearly £400.

Clipping Blackface Sheep.

The next item was the appointment of three representatives of the Board of Directors to act on the Committee appointed at the general meeting in the Inverness showyard to consider and report as to the date for clipping Blackface sheep to be exhibited at the Society's Show.

The Secretary said that the Committee was to consist of nine members, six of whom were elected at the Inverness meeting—viz., Sir Robert Menzies; Messrs Gordon, Achallater; Wallace, Auchenbrain; Howatson, Glenbuck; Watters, Glenample; and Craig, Innergeldie. The other three had to be appointed by the Directors, one of whom would be convener.

Sir Robert Menzies said that he did not think there was any use in calling the Committee together. He was a little deaf, and did not hear the names proposed at the meeting, or else he would not have allowed them to pass. All those nominated were in favour of early clipping, and early clipping was, in his opinion, harmful. He had not succeeded, but he would keep working away.

It was agreed to appoint Messrs Walter Elliot, R. Sinclair Scott, and W. S. Ferguson. Mr Sinclair Scott was named as convener.

Special Prizes.

The following special prizes were accepted with cordial thanks:—

The Earl of Aberdeen, President of the Society—Champion medal for the best animal or pen in each of the sections of live stock, as at Inverness

Clydesdale Horse Society—Cawdor challenge cup for best Clydesdale mare or filly, on same conditions as at Inverness.

Sir John Gilmour of Montrave, Bart.—£25 in prizes for yearlings by Thoroughbred stallions, as at Inverness.

Captain Clayhills Henderson of Invergowrie, R.N.—£27 in prizes for Hunter brood mares with foal at foot or to foal this season, as at Inverness.

Hunters Improvement Society—Gold medal, value £10, 10s. for best Hunter filly, foaled in the year 1899, 1900, or 1901.

Hackney Horse Society—Gold medal, value £10, for the best mare or filly in the Hackney or Pony classes, provided the prizes offered in these classes amount to £150.

Lord Tweedmouth—Special prize of £20 for Pony stallion, not exceeding 14·2, best adapted to get ponies out of Highland pony mares suitable for mounted infantry, it being provided that the stallion which wins this prize shall serve Highland pony mares in 1903 in such of the northern counties and at such centres as may be hereafter arranged by the Society, at the following fees—viz., one guinea per mare, with a further fee of one guinea per foal.

Sir Robert Menzies, Bart.—£18 for prizes for wool as follows: (*a*) Blackface wether wool, five fleeces, £3, £2, and £1; (*b*) Blackface ewe wool, five fleeces, £3, £2, and £1; (*c*) Blackface ewe or wether hogg wool, five fleeces, £3, £2, and £1—all fleeces

to be white, unwashed, and shorn in the year of the Show from sheep bred and reared on, or regular stock of, the exhibitor's farm.

Polled Cattle Society—Two gold medals—one for the best breeding male animal and the other for the best female animal of the Aberdeen-Angus breed in the showyard.

Sir JOHN GILMOUR suggested, in regard to the Lord Tweedmouth prizes, that some definite number of mares to be served should be stated. That seemed to him to be a necessity, as one might only serve ten pony mares. He thought he ought to be bound to serve at least thirty or forty pony mares at that price. After that he could charge his own figure.

It was agreed to put this suggestion before Lord Tweedmouth.

The wording of the Polled Cattle Society's prize, with reference to the "best breeding male animal," gave rise to some discussion.

It was agreed to ask the Society to be good enough to substitute for "breeding male animal" the word "bull."

DUMFRIES SHOW, 1903.

The SECRETARY reported that an agreement had been made for the site of the Show on the old racecourse at Tinwald Downs. A letter had been received from the Town Council of Dumfries intimating a grant of £75 in aid of the expenses of the Show.

VETERINARY EXAMINATION AT SHOWS.

A letter was read from the council of the National Veterinary Association, forwarding the following resolutions adopted at the annual general meeting of the association held at Edinburgh on 1st August 1901, viz.: "(1) That it be a recommendation from this association that horses exhibited at agricultural shows or other exhibitions in Scotland should be submitted to a veterinary examination." "(2) That 'stringhalt' and 'shivering' should be included in the list of diseases which disqualify breeding animals for prizes."

The CHAIRMAN. What is to be done with that?

Dr GILLESPIE. I would just decline it.

Mr W. S. FERGUSON. I think we should take no action.

Dr GILLESPIE said that if veterinary surgeons could agree among themselves what was unsoundness it would help to settle the question, but he thought that in the present state of matters it was best left alone. He moved accordingly.

Mr CLARK, Netherlea, seconded, and this was agreed to.

TUBERCULOSIS.

The SECRETARY stated that it would be fresh in their memories that they had granted £100 to Aberdeen University for the carrying out of certain experiments in tuberculosis. These experiments were nearly finished, and they had not spent more than £50 of the grant, so they now approached the Society to allow them to use the other £50 in carrying out experiments with the object of testing the soundness of Professor Koch's recent statement to the effect that tuberculosis in man cannot be transmitted to bovine animals.

The CHAIRMAN said that they would observe that there was no additional grant asked.

This was agreed to.

TESTING MILK.

The SECRETARY submitted letters from Mr A. Barns Graham, jun., Craigallian, Milngavie, suggesting that the Society should provide facilities for the testing of milk, in view of the recent order of the Board of Agriculture regarding the standard composition of milk. The Science Committee gave the matter their very careful consideration, and recommend that any tests conducted by the Society should be conducted by the best-known methods, and, therefore, that it be arranged that the Society's chemist undertake analysis for butter-fat alone, the cost of such investigation to be 2s. 6d. for each sample, to be paid by the sender, and 2s. 6d. to be paid by the Society, making 5s. for the test.

This was agreed to.

OVER-DRESSING OF BARLEY.

The SECRETARY laid on the table the report of the conference on this subject held in the showyard at Inverness.

Mr MIDDLETON said that the conference brought out the fact that manufacturers thought, if intelligently used, the present machines were perfectly qualified to dress the grain properly.

Mr M'Hutchen Dobbie disagreed with this. He had tried it, and he could not get the mill to thresh clean without breaking the barley. He held that there should be some alteration in some way, and the Society should encourage makers to alter their drums. He thought a very substantial prize should be given to the man who provided a drum that would thresh clean and not break the grain. He moved that it be remitted back to the Committee to consider the matter.

Sir Robert Moncreiffe seconded, and this was agreed to.

MEETING OF DIRECTORS, 4th DECEMBER 1901.

Present.—Vice-President—Mr Campbell, Old Cullen. *Ordinary Directors*—Mr E. Hedley Smith, B.L., Whittinghame; Mr William Clark, Netherlea; Sir Alan H. Seton-Steuart of Touch, Bart.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr R. Sinclair Scott, Burnside; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Mr John Marr, Cairnbrogie; Mr C. M. Cameron, Balnakyle; Mr C. H. Scott Plummer of Sunderland Hall; Mr William Taylor, Park Mains; Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr Robert F. Dudgeon of Cargen; Mr John Wilson, Chapelhill, Edinburgh; Mr Alexander Cross of Knockdon; Mr A. H. Anderson, Kippendavie; the Earl of Mansfield, Scone Palace; Mr John M'Caig, Challoch; Mr William Duthie, Tarves; and Mr John Cran, Kirkton. *Extraordinary Directors*—Mr John Findlay of Aberlour; Sir Ralph Anstruther of Balcaskie, Bart.; Mr George R. Glendinning, Hatton Mains; Mr Robert Paterson, Hill of Drip; Mr Walter Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr John Speir, Newton Farm; Mr Jonathan Middleton, Clay of Allan; and Mr W. T. Malcolm, Dunmore Home Farm. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Hon. Secretary*—Sir John Gilmour of Montrave, Bart. *Auditor*—Mr William Home Cook, C.A. *Chemist*—Dr A. P. Aitken. Sir Ralph Anstruther of Balcaskie, Bart., in the chair.

The Chairman at the outset thanked the Directors for electing him their Chairman. He appreciated the honour very highly. He had not the technical knowledge of the business, or agricultural experience of his predecessors, but with the kind assistance of the Directors and the officials he hoped to be able to conduct the business as it ought to be conducted, and in a way that would make the work go pleasantly.

Minutes and General Meeting.

The minutes of meeting of 6th November were held as read, and adopted. The annual general meeting was appointed to be held on 8th January 1902, the Board to meet on same date.

Aberdeen Show.

Reports of meetings of the Shows Committee dealing with the premium-list were submitted. The dates of closing entries would correspond with those for the Inverness Show. The recommendation of the Highland Cattle Society that cows should be in milk, and have calf at foot, was rejected—the regulation in question standing as before—"in milk or have calf at foot." Mr Clark's motion, that the use of soap or other adhesive matter in dressing cattle or horses be prohibited, was adopted. Rule 49 was subject to a suggestion of the Highland Cattle Society—viz., that the use of stall-collars, or straps below the chin in showing Highland bulls, be prohibited, but this was not agreed to. Some changes were made on the regulations for poultry, the principal being that the poultry shed be closed at 4 P.M. on the Friday. The classes and prizes will all be as at Inverness, except that there will be no jumping class for ponies, and that classes will be opened for table poultry of any breed or cross. The total prize-money offered by the Society is £2379, an increase of nearly £400 as compared with the premiums offered at Aberdeen in 1894.

Highland Ponies.

Some discussion took place as to the offering of premiums for Highland ponies. Mr J. H. Munro-Mackenzie of Calgary was prepared to offer prizes for two classes—one for pony stallions and the other for pony mares. It had, however, been sug-

gested that these were classes which the Society should itself provide. Mr Mackenzie in that case would offer champion prizes.

The CHAIRMAN explained that the proposal was to adopt in these classes the standard of the Polo Pony Society, and thus get over the difficulty of defining a Highland pony. Sir John Gilmour expressed himself as not quite satisfied with this. He wanted to know what the standard for the Highland section of the Polo Pony Stud-Book would be. The object of the Highland and Agricultural Society should, he thought, be to encourage the breeding of animals that would carry themselves to the hills and their stock back. They should be careful before they quite agreed to the condition named.

It was agreed to remit the question to a small committee, consisting of Sir John Gilmour, the chairman, the steward of horses (Mr Ferguson), and the Secretary.

Special Prizes.

It was unanimously agreed to accept a champion prize of £10 by Lady Estella Hope for the best Shetland pony.

Prizes were offered from the Suffolk Sheep Society, but as they were subject to the condition that the judges of Suffolk Sheep be appointed from the list submitted by the Suffolk Sheep Society the offer was not accepted.

Clipping Blackfaces.

Mr R. SINCLAIR SCOTT moved the adoption of the report of the Joint-Committee appointed at the Inverness meeting, which recommended that Blackface sheep intended for exhibition be clipped bare any time on or after 1st January of the year of the Show. The Committee, Mr Scott said, had given the matter most careful consideration, and were agreed that it was not advisable to make the change suggested by Sir Robert Menzies, Sir Robert alone objecting.

Mr A. H. ANDERSON seconded.

Sir ROBERT MENZIES opposed the recommendation, and said it was notorious that the present system of clipping and house-feeding Blackface rams was weakening their constitution. He rehearsed what had been done at Stirling and Inverness, expressing the view that nothing else was to have been expected from the Inverness Joint-Committee, which was composed of ram-breeders. He hoped to be able to again raise the question at the Aberdeen showyard meeting.

Mr SCOTT PLUMMER moved that the report be not adopted, and that the date be 1st May. It was, he said, a very extraordinary thing for that Society to give countenance to the idea that it was a proper thing to clip sheep in the middle of winter. The great qualification of the Blackface sheep was its superior hardiness. It was this that made it the great sheep of Scotland. Here they were asked to support the idea that the rams of this breed were to be brought up under conditions absolutely fatal to hardiness. They were crowded with wool when they should be bare, and no wonder they required to be kept in the house and fed artificially when clipped in midwinter. If there was anything in heredity, rams so treated must perpetuate a poor lot of sheep. All who had been selling sheep in markets spoke against this regulation, and regarded it as a movement in the wrong direction.

Sir ROBERT MENZIES seconded.

Mr T. GORDON DUFF agreed with Mr Scott Plummer. That Society ought not to do anything that would interfere with the primary qualities of the Blackface breed. Too much consideration had been given in dealing with this question to the interests of the Show. They were not there solely to make the Show pay. The greater interests of the breed ought to overshadow the interests of the Show.

Mr JOHN MARR, as one who had been steward of the Blackface sheep section for several years, said the great growth of wool was necessary to show what the sheep could do in growing a fleece. It was also said that any duffer could judge a clipped sheep, but it took a man to judge a sheep in full fleece.

Mr SINCLAIR SCOTT, in replying on the debate, denied utterly that the present system of feeding rams was detrimental to the health of the sheep. He asked the Board not to be biased by the opinions expressed there. The question was one which really concerned the Society very little. It was a question for those who were making their living off the breeding and selling of tups. Nothing they did there was going to affect their action. It might affect fifty or sixty sheep, and if the amendment was carried they would have no show of Blackfaces at all. It would not pay them to act differently for the Show than they had to do for the purposes of trade. He ventured to think that the best plan was to withdraw all restrictions, and let every man act as he saw it to be best for his own interests.

A vote being taken, five voted for Mr Scott Plummer's amendment, and eighteen

for the approval and adoption of the report. The clipping date is therefore 1st January in the year of the Show at which the animals are exhibited.

District Societies.

The Committee reported the grants to these societies last year (1901) amounted to £452. The lists had been revised that day, and grants recommended for 1902 of £587, which is a little more than double the amount spent in this way in 1893, and £135 more than was spent in 1901.

MEETING OF DIRECTORS, 8th JANUARY 1902.

Present.—Ordinary Directors—Mr E. Hedley Smith, B.L., Whittinghame; Mr William Clark, Netherlea; Sir Alan H. Seton-Steuart of Touch, Bart.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr Alexander M. Gordon of Newton; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; Mr John Marr, Cairnbrogie; Rev. John Gillespie, LL.D., Mouswald Manse; Mr C. M. Cameron, Balnakyle; Mr C. H. Scott Plummer of Sunderland Hall; Mr William Taylor, Park Mains; Mr F. W. Christie, Dairsie Mains; Mr John M'Hutchen Dobbie, Campend; Mr St Clair Cunningham, Hedderwick Hill; Mr Alex. Cross of Knockdon; Mr A. M. Anderson, Kippendavie Estate Office; the Earl of Mansfield, Scone Palace; Mr John M'Caig, Challoch; Mr William Duthie, Tarves; and Mr John Cran, Kirkton. *Extraordinary Directors*—The Hon. Charles Forbes Trefusis, Fettercairn House; Mr Garden A. Duff of Hatton; Mr Charles E. N. Leith-Hay of Leith Hall; Mr James Hay, Little Ythsie; Mr David Hume, Barrelwell; Sir Ralph Anstruther of Balcaskie, Bart.; Mr George R. Glendinning, Hatton Mains; Mr Robert Paterson, Hill of Drip; Mr Walter Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr John Speir, Newton Farm; Mr Jonathan Middleton, Clay of Allan; and Mr W. T. Malcolm, Dunmore Home Farm. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Hon. Secretary*—Sir John Gilmour of Montrave, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr William Home Cook, C.A. Sir Ralph Anstruther, Bart., in the chair.

Aberdeen Show—Special Prizes.

The following special prizes were intimated: By Shropshire sheep-breeders, £10 for cross-bred lambs by a Shropshire ram. By the Oxford Down Sheep-Breeders' Association, £10 for cross-bred lambs by an Oxford Down tup. By Mr Howatson of Glenbuck, £10 for the best five Blackface shearling tups; and £14 (in prizes of £8, £4, and £2) for Blackface shearling tups, best adapted for producing stock to yield early-maturity mutton, irrespective of wool value.

Highland Ponies.

It was agreed that there should be two classes for Highland ponies at the Show—for stallions and mares three years old and upwards, not exceeding 14·2; and a special prize of £10 for these classes was intimated on behalf of the Polo Pony Society.

Over-dressing Barley.

A Committee, which was appointed last year to consider the question of the over-dressing of barley, reported that since the subject had been taken up by the Society considerable improvement had taken place in the threshing of barley. It had been suggested that premiums should be offered for a trial of threshing-machines in connection with some of the Shows, but the prevailing opinion in the Committee was that they should make an investigation into the improved mills at present working or soon to be set agoing. The report was approved, and the Committee were authorised to expend £50 in their investigation.

Show of 1904.

It was agreed to hold the Show of 1904 at Perth.

TESTING SEEDS.

Mr JOHN SPEIR, Newton, moved that the Directors invite the Council of the Royal Agricultural Society of England to co-operate with them in arranging a conference with the principal botanists, so that some recognised method of testing seeds and tabulating the results might be adjusted and adopted by the botanists. His desire was, he said, that they should do for botanists what the Chemical Society had done for chemists, and have one standard method of testing seeds, so that they might obtain uniformity in results.

Mr CROSS, Knockdon, seconded the motion.

The Rev. Dr GILLESPIE, in supporting the motion, said he did not think they should acquiesce in Mr Hanbury's decision to do nothing in the matter, but that they should press it upon the Government whenever opportunity offered.

It was agreed to remit the motion to the Science Committee for consideration and report.

VARIOUS.

It was agreed to make the usual grant of £50 to the Lectureship on Forestry in Edinburgh University.

The judges for the Aberdeen Show were afterwards appointed.

PROCEEDINGS AT GENERAL MEETINGS.

GENERAL MEETING, 5TH JUNE 1901.

Mr A. M. GORDON of Newton in the chair.

OFFICE-BEARERS.

The Office-Bearers were appointed as follows: *President*—The Earl of Aberdeen. *Vice-Presidents*—The Earl of Kintore; Lord Saltoun; Mr James Campbell, Old Cullen; and Mr Andrew Hutcheson, Beechwood. *Ordinary Directors*—Mr St Clair Cunningham, Hedderwick Hill; Mr Alexander Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; the Earl of Mansfield, Scone Palace; Mr C. J. Cunningham, Wooden; Mr John M'Caig, Challoch; Mr William Duthie, Tarves; and Mr John Cran, Kirkton. *Extraordinary Directors*—The Lord Provost of Aberdeen; Mr G. A. Duff of Hatton; Mr James Hay, Little Ythsie; the Hon. Charles S. Forbes Trefusis, Fettercairn; Sir David Stewart of Banchory, Aberdeen; Mr David Hume, Barrelwell; Mr Charles E. N. Leith-Hay of Leith Hall; Mr George J. Walker, Portlethen; Colonel George Smith-Grant of Auchorachan; Mr John Findlay of Aberlour; Sir Ralph Anstruther of Balcaskie, Bart.; Mr George R. Glendinning, Hatton Mains; Mr Robert Paterson, Hill of Drip; Mr Walter Elliot, Hollybush; Sir Robert Menzies of Menzies, Bart.; Mr John Speir, Newton Farm; Mr Jonathan Middleton, Clay of Allan; Mr Charles Howatson of Glenbuck; Mr W. T. Malcolm, Dunmore Home Farm; and Captain Clayhills Henderson of Invergowrie, R.N.

INVERNESS SHOW, 1901.

Mr JONATHAN MIDDLETON, on behalf of the convener of the Local Committee, reported that the arrangements for the Inverness Show, to be held on the 17th July and three following days, are well advanced. The leading agriculturists in the northern counties had manifested the heartiest interest in the Show, and the people of the town of Inverness were just as anxious to co-operate in promoting its success. The local fund raised in aid of the Show will be found to be almost, if not quite, a record one, and will certainly reflect much credit on the liberality and public spirit of the counties of the Inverness Show district. Entries were coming in very well, and, with favourable weather, the people of the North look forward to a highly successful and interesting Show.

ABERDEEN SHOW, 1902.

Mr GORDON of Newton reported on the arrangements for the Show of 1902, to be held at Aberdeen. These arrangements were progressing satisfactorily. The counties of Aberdeen, Banff, and Forfar had taken steps for the raising of a local fund by means of a voluntary assessment on owners of land and heritages. It was to be regretted that the County Council of Kincardine had not followed this example, but it was hoped that by private subscriptions Kincardineshire would contribute handsomely to the local fund. The county of Kincardine shared liberally in the Society's grants to local societies, and no doubt the agriculturists of the county will bear this in mind when the time comes for the raising of a fund for the Highland Show at Aberdeen.

DUMFRIES SHOW, 1903.

Sir JAMES H. GIBSON-CRAIG stated that arrangements had advanced so satisfactorily that the holding of the Society's Show for 1903 at Dumfries was now assured. One of the largest local funds ever raised for a Highland Show was provided for the Dumfries Show of 1895, and he was glad to be able to say that there was good reason to believe that the local fund for the Show of 1903 would be quite as handsome. Already the County Councils of Dumfries, Kirkcudbright, and Wigtown had taken steps for the raising of a local fund by means of a voluntary assessment on owners of land and heritages; while the Town Council of Dumfries had most promptly assured the Society of its liberal and hearty support.

EDUCATION.

Dr GILLESPIE reported that the second annual examination for the National Diploma in Agriculture took place in the Yorkshire College, Leeds, on the 6th ult. and following days. At the first examination held last year seven candidates passed Part I., thus qualifying themselves to enter this year for Part II. Six of these came forward, five succeeding in obtaining the diploma. None of them obtained honours marks, so that the gold medal was not awarded this year. For Part I. forty-two candidates entered, including sixteen who had been unsuccessful in 1900. Of the forty-two candidates, two were absent, twenty passed, and twenty failed. Among the twenty who passed in Part I. were ten who were unsuccessful last year, and it was gratifying to note the very marked improvement made by these students at their second attempt.

FORESTRY DEPARTMENT.

Sir ROBERT MENZIES reported that the Forestry examination was held from the 9th to the 11th of April, when five candidates came forward. The examination resulted in one candidate passing for the first-class certificate and three for the second-class certificate. According to the recommendation of the Council on Education the next examination falls to be held in April 1903.

CHEMICAL.

Mr JOHN M. MARTIN reported on behalf of the Science Committee. He stated that at the invitation of the Board of Agriculture the Society has undertaken an experiment on the improvement of pasture, and especially of hill pasture, by means of the application of such manures as are suitable and economical for that purpose. The improvement of the pasture is to be determined by the increased number of sheep which the various plots are able to support, and the quality of the mutton produced, as well as by the quantity and quality of the herbage. An experiment of this kind has been carried on for some years in the north of England by the agricultural department of the Durham College of Science, and latterly by that of the University of Cambridge. The Board of Agriculture has shown its interest in the investigation by giving a substantial grant in aid of the expense involved, and in offering grants for similar experiments if carried out in the west and east of Scotland. The West of Scotland Agricultural College has offered to conduct the experiments in the west, and the Highland and Agricultural Society has offered to do the same in three important sheep-feeding districts in the east. Through the kindness of Mr Shirra Gibb, Boon, Lauder; Mr C. H. Scott Plummer of Sunderland Hall, Selkirk; and Mr John J. Moubray of Naemoor, Rumbling Bridge, large fields on their farms have been placed at the disposal of the Society, and these have been divided by permanent fences into five plots of 4 acres each, and stocked with sheep of a kind suitable to the respective districts. For the purpose of assisting those in charge, and at the same time creating a greater amount of local interest, a small Local Committee has been appointed at each place. Although the fields selected are apparently of fairly even quality, it has been deemed prudent to graze the plots during the first summer without applying any manures, so that the relative feeding value of the various plots may be tested. It is intended that the experiment shall be continued for as many years as it is found that results of value are obtained. The experiment to discover why it is that the application of basic slag is attended with good improvements on some pastures, and with no apparent result in others, is progressing. The soil taken from a number of fields of both kinds will, in the first place, be analysed.

BOTANICAL.

Professor M'ALPINE reported as follows: I have the honour to report that, during the past season, I have tested over sixty samples of grass and clover seeds. No fault

can be found with the purity, as the percentage of pure seeds very often reached 100, and only in rare cases fell to 95. But the power of germinating, although usually very high, was sometimes very low, either because an excessive proportion of husks without kernels was present, or because many dead and rotten seeds occurred in the samples. Obviously, higher powers of germinating would be attained in defective seeds if a more thorough cleaning removed the empty husks, and if more attention was paid to the source and age of the seeds. The following is a tabular statement of the maximum and minimum percentages obtained from the more important grasses and clovers tested:—

	Germination. Max.	Germination. Min.	Purity. Max.	Purity. Min.
Grasses—				
Perennial ryegrass	96	87	100	98
Italian	97	70	100	99
Timothy	98	92	100	99
Cocksfoot	95	63	100	98
Meadow fescue	98	91	100	99
Clovers—				
Red	97	90	100	98
Alsyke	98	85	100	97
White	98	50	100	95
Trefoil	97	45	100	99

A vote of thanks to the Chairman terminated the proceedings.

GENERAL MEETING IN THE SHOWYARD AT INVERNESS, 17TH JULY 1901.

LOCHIEL occupied the chair.

SIR JAMES GIBSON-CRAIG moved a cordial vote of thanks to the Provost, Magistrates, and Town Council of Inverness for their assistance and co-operation in furthering the success of the Show, for providing a suitable site free of charge, and for their contribution to the funds. They had never, he said, been better treated than at Inverness, and they had the great advantage of having a showyard free of charge. In many places they found difficulty in getting a suitable showyard, but in the capital of the Highlands they had that difficulty solved for them in a most satisfactory manner.

Mr JOHN SPEIR, Newton, seconded the motion, which was unanimously adopted.

Provost M'BEAN, in responding to the motion, said his only regret was that owing to the many demands made on their common good, especially on account of the war in South Africa, his colleagues and himself had not been able to contribute so largely to the funds of the Show as in their hearts they could have wished. But they were compensated to some extent by the fact that in the endeavour to make that magnificent Show a success, they had been able to grant the Society the free use of their public park. If he had any influence with his colleagues, he thought there would be no charge made for water or anything in connection with the Show. Nothing possible could have given greater pleasure to the members of the Town Council and the community of Inverness, and Highlanders generally, than that the living representative of one of their most powerful and most beloved clans—the Camerons—should be President of the Society. However loyal they might be to their King and country, and he believed that his Majesty had no more loyal, devoted, and patriotic subjects throughout his vast dominions than the Highland people, the historic name of Lochiel would always be cherished in affectionate remembrance by all Highlanders.

The Rev. Dr GILLESPIE moved that the thanks of the Society be given to the subscribers to the fund in aid of the Show, and to the donors of special prizes, for the liberal support they had given to the Society. There was, he said, a competition among the different Show districts as to which was the most liberal in local contributions; but he had the satisfaction of announcing that, next to Glasgow, Inverness held the field. For many years the district of the Queen of the South, from which he had the honour to hail, was prominent in that respect, but they now gave place to the capital of the Highlands and its district. Any doubt which existed as to the propriety of visiting Inverness must now for ever be removed, and the youngest

amongst them would not see the day when the Society ceased to come to Inverness. In addition to giving them a free site, the district of Inverness had contributed by donations £1703, a sum only exceeded by the Glasgow district, which included Lanarkshire and Ayrshire, where they drew not only from the surface of the earth but went as far down as they could. Old man as he was, he trusted he would live to see three or four Highland Shows at Inverness. They appreciated the reception they had got in Inverness, and he hoped great good would result from the Show. It was a small matter whether it was a financial success or not. They did not live for finances alone. They were all the better of the people that went before them. They had a nest-egg—something in the back-shop—and while they could afford to lose a pound or two, he did not know that they would lose anything. He believed it would be a record Show, even if they lost a small sum.

Mr JOHN WILSON, Chapelhill, seconded the resolution, which was adopted.

Mr J. M. MARTIN moved a vote of thanks to the Local Committee, and this was seconded by Mr ANDREW HUTCHESON of Beechwood, and agreed to.

Mr JOHN MACPHERSON GRANT of Ballindalloch suitably replied.

THE CLIPPING OF BLACKFACED TUPS.

Sir ROBERT MENZIES moved—"That the date at which the Highland and Agricultural Society permits the clipping of Blackface tups for exhibition at its annual Show —viz., 1st February—is much too early, and that it be remitted to a committee of extensive sheep-graziers to fix the date." Sir Robert thought there could not be the slightest doubt whatever that clipping sheep on 1st January was a most harmful and pernicious thing. The result had been that a large number of sheep were much more delicate than they ought to be. He thought, instead of having no arrangement for clipping sheep, as was proposed in the amendment to be submitted, the better plan was to refer to a Committee of Blackfaced sheep-breeders to fix the date at which the clipping should take place. Of course some farms were high, and some were low, and therefore it might be difficult for the Committee to fix a date. In his district he was quite sure the 1st May would give enough time. He dared say some near the sea-coast would prefer a date a little earlier.

Mr ROLLO, Perth, seconded the motion.

Mr JOHN CRAIG moved—"That inasmuch as the clipping regulations in respect to Blackfaced sheep shown at the annual Shows of the Highland and Agricultural Society of Scotland are unsatisfactory, it is desirable to do away with all restrictions." He had been in communication with practically all the exhibitors at the Highland Show in recent years, and he might say not a single exhibitor maintains that the reversion to 1st February was at all likely to be a success, so far as the Shows of the Society were concerned. In fact, every one of them had held out that if they fixed the date later than 1st January they must be prepared to see very many fewer pens filled at their Shows than had been the case in the past. These gentlemen had, in communication with him, universally almost said that 1st January was, to a certain extent, quite satisfactory to them. It admitted of their clipping their sheep with the double purpose of the showyard and the saleyard, and any later date would not suit them in this respect. He would think that the cords which bound the Blackfaced exhibitors to the Society would be very severely strained if they brought the showyard into competition with the saleyard at all. The matter of the showyard was far more visionary than the saleyard, the saleyard was more material. It was the saleyard that paid the rent. It was possible that the breed might not be quite so hardy as it was,—he hardly thought that was the case,—but if they examined this question they would find that it was not the early clipping that caused any deterioration. If they were to fix 1st June, they would find every one of the sheep would be put into the house and fed equally as at present. It would be perfectly suicidal to say sheep without shelter would thrive or live as well as sheep with shelter. He did not think the Blackfaced breeders were to blame for taking every advantage which modern knowledge had put in their reach. He submitted that the showyard was not the place to deal with the hardiness of the sheep. They must go to the saleyard if they were to combat it with any strength. A single buyer who was willing to give a good price for a moderately brought-out lot of sheep would have more strength than if they were to place restrictions on every society in Scotland. He did not think it was the province of the Society to save those gentlemen who bought sheep from the unwisdom of buying sheep which did not suit them. If they would for one year be anxious to create a demand for a naturally brought-out sheep there would be a supply for the following year that would more than meet the demand. There was nothing that struck one in connection with Blackfaced hill farming more than the fact that large tracts were being cleared of sheep, not on account of the hardiness of the sheep, not on account of the fact that they could not produce wool and mutton, but that when they had produced it it was not of sufficient value to pay the rent. If

the Society was going to be of the same use in the future as it had been in the past to the Blackfaced and other breeds, they would be far better occupied in freeing them of restrictions than in strangling the free enterprise and resourcefulness of breeders.

Mr WALLACE, Auchenbrain, seconded.

Mr PETER M'INTYRE, Teanablair, moved that it be remitted to a Committee of three sheep-graziers, two breeders of Blackfaced rams, and three members of the Board of Directors (to be elected by the Directors), with a member of the Board of Directors as convener, to consider and report to the members as to a suitable date for the clipping of Blackfaced sheep at the Highland Show; and that the following be the members of Committee to be appointed by that meeting: Sir Robert Menzies; Mr Gordon, Auchallater, Braemar; Mr Wallace, Auchenbrain; Mr Howatson, Glenbuck; Mr Waters, Glenample; and Mr Craig.

Mr JOHN M'MILLAN, Glencrosh, seconded.

Dr GILLESPIE said, in his opinion, a very delicate and independent inquiry should be made. The best plan, he thought, was to appoint such a representative and independent Committee as had been suggested He thought the state of the entries at the Show as compared with the entries at previous Shows of Blackfaced sheep, was a demonstration that this tendency to put the date forward was not conducive to increase of entries, because they had fewer there than they had had in his recollection. He thought they should go about this matter most deliberately, in the way suggested by Mr M'Intyre.

Mr GORDON, Cullisse, thought the exhibitors and the buyers should be the best judges as to restrictions.

Sir ROBERT MENZIES having replied, a vote was taken, with the result that Mr M'Intyre's amendment was carried by a large majority.

On the motion of Mr GORDON, Newton, the Chairman was cordially thanked for presiding, and in responding Lochiel paid a compliment to the Secretary of the Society for the services he had rendered in making the Show a success.

ANNIVERSARY GENERAL MEETING, 8TH JANUARY 1902.

Sir RALPH ANSTRUTHER in the chair.

The CHAIRMAN read an apology from Lord Aberdeen (President) regretting his inability to be present owing to the pressure of other engagements.

FINANCE.

Sir JAMES H. GIBSON-CRAIG, Hon. Treasurer, laid on the table the volume of the Society's Accounts for the year to 30th November 1901, as audited by the Society's Auditor. The total receipts for the year amounted to £11,233, and the expenditure to £10,145, leaving a balance of £1087. In view of the fact that the Show of last year fell to be held at Inverness, where the Show has hitherto resulted in a substantial loss, the Directors anticipated that the Society's income for the year would not have been equal to the outlay. Fortunately, however, the Inverness Show of last year was so successful as to do something more than pay its own expenses, and largely on this account the Directors have been enabled to add a sum of £2000 to the Society's invested capital. Sir James explained that the reason why they had any money on hand was because they had hitherto always made a loss at Stirling and Inverness; but as matters had turned out, the money they had held over to meet that was not required for that purpose, and they had added it to the Reserve Fund. He desired to congratulate their worthy Secretary on the fact that on the eight Shows of the circuit since his appointment the Society had made a profit on seven and only a loss on one. The Border district was the only one in which a profit had not been made He hoped that now they had begun a second circuit under Mr Macdonald's guidance, that they would be able to make it pay all round. It was necessary to add to the Reserve Fund, as the rate of interest was always falling, and at present, though they had a much larger Reserve Fund than they had twenty years ago, they had not a great deal higher income from interest than at that time. Then their liability was also increasing, as every additional member meant more liability. They were also endeavouring to extend their support to local societies, and hoped to be able to carry on the system as they had been doing in the past.

Argyll Naval Fund.

Sir Robert Menzies submitted the Accounts of the Argyll Naval Fund for 1900-1, which showed that the income for the year amounted to £205, 7s. 8d., while the expenditure was £200, made up by a grant of £40 to each of five naval cadets. He also stated that a vacancy had occurred in the list of beneficiaries by the promotion lately of Mr Edward L. Grieve, and that the Directors, on the recommendation of the Argyll Naval Fund Committee, had that day nominated Mr Evan Campbell Bunbury, grandson of the late Captain D. P. Campbell of Balliveolan, Argyllshire, to fill this vacancy.

Inverness Show, 1901.

Mr C. M. Cameron reported upon the Inverness Show of last year. The Show was favoured with excellent weather, except for a few hours on the closing day, when rain fell heavily, causing much discomfort to visitors, and no doubt slightly curtailing the drawings at the gates. The Society is much indebted to the agriculturists in the northern counties, and to the town of Inverness, for the enthusiastic support they gave in connection with the Show. The local fund raised in aid of the expenses of the Show was almost the largest in the history of the Society, and it is worthy of note that several of the local agricultural societies subscribed handsomely. The Town Council of Inverness co-operated most heartily with the Society, providing, free of charge, one of the most delightful sites the Society has obtained for many a year, subscribing liberally to the local fund, and in many other ways contributing to the success of the Show. For the first time in the history of the Society the Inverness Show has brought out a balance on the right side. The receipts of the Show exceed the outlay by about £100, a pleasing contrast to a loss of £1088 in 1892, of £838 in 1883, and £1401 in 1874. This is all the more gratifying when it is remembered that the amount offered in premiums last year was nearly £900 more than the sum offered in 1892.

Aberdeen Show, 1902.

Mr Alex. M. Gordon, Convener of the Local Committee, reported that arrangements are progressing satisfactorily for the Show to be held at Aberdeen on the 15th of July next and the three following days. The Town Council had, as in former years, met the Society handsomely, agreeing to give a site for the Show on the Links free of charge, subscribing £100 to the local fund, and providing a free supply of water. The County Councils of Aberdeen, Banff, and Forfar (eastern division) had resolved to raise contributions to the local fund by means of voluntary assessments. Unfortunately the County Council of Kincardineshire had not seen its way to follow this example, but it was confidently hoped that by private subscription a sum will be raised in that county; which, by the way, has always shared liberally in the grants which the Society gives annually to local societies. A handsome list of premiums has been prepared for the Show, the sum offered in prizes from the Society's own funds exceeding £2380, and being about £470 more than the sum offered by the Society at the Aberdeen Show in 1894. They would be delighted if they had as good weather as they had eight years ago, when they made the substantial addition of £1700 to the Reserve Fund of the Society.

The Hon. Mr Trefusis, convener of the county of Kincardine, said that he hoped they would do something substantial in that county, although they had not been able to get a voluntary assessment. He intended to give the matter his attention at once.

Dumfries Show, 1903.

Sir James H. Gibson-Craig, Convener of the Shows Committee, reported that for the Show of 1903 an admirable site had been secured on the old racecourse at Tinwald Downs, Locharbriggs. In aid of the Show held at Dumfries in 1895 the district raised a local fund of no less than £1701, and it is hoped that the local support to the Society will be equally liberal for the Show of 1903. Already the Town Council of Dumfries had resolved to contribute a sum of £75 from the burgh funds. Last time they had been unfortunate only in respect of the field in which the Show was held, which was young grass, and on the last day, when they had wet weather, perhaps the wettest day the Show had ever been held in, it was not a good field.

Show of 1904.

Sir James H. Gibson-Craig moved that, provided satisfactory financial and other arrangements can be made, the Show for 1904 be held at Perth. This was unanimously agreed to.

Veterinary Inspector for the Society.

Mr Lawrence Johnston, Sands, in terms of notice given, moved that the Society should have a permanent veterinary inspector, and that the Directors be instructed to appoint as permanent veterinary inspector Principal Owen Williams, to succeed his father. Speaking to his motion, Mr Johnston said that on the death of the late Principal Williams the Directors had resolved not to fill that place again, but to rely on the advice of district vets., according as the Show visited the localities. He did not consider this a satisfactory state of affairs for a Society such as theirs. In a small place, as a rule, the vets. might be very satisfactory, but yet the fact that they remained in a small place was rather a proof that they were not first-class men. Seeing that the Government had rightly or wrongly prevented the importation of Canadian cattle in the interests of stock bred in this country, it was surely highly important that the showyard of such a Society should be protected from disseminating diseases, and for this reason there should be a first-class veterinary surgeon at the head of affairs in the yard. An outbreak of disease at a Show such as theirs would lead to an immensity of loss, from which it would take years to recover. He had nothing against local vets., but he was of opinion that they might be inclined to be lenient to their own clients. There ought to be an impartial referee, who was able to hold the highest position in the veterinary world. He believed they had all these qualifications in Principal Owen Williams. He had known him for the last twenty years as a practical veterinary surgeon, and he had had experience of veterinary surgeons in England, Scotland, and Ireland, and knew no one more efficient and no one he could trust more. He did not think the Directors had considered the enormous responsibility they were incurring by trusting their showyard to the control of what might be called peripatetic surgeons, by having different men every year. They might have conflicting opinions, for example, as to the measurement of ponies. The right thing for a Society like theirs was to have a professional adviser, in whom the Society could have complete confidence, and who would discharge his duties in an able, conscientious, and efficient manner. He had no doubt that Principal Owen Williams would become as distinguished a member of the profession as his famous father.

Mr T. M. Skirving seconded, but at the same time he doubted if it was quite wise to ask the meeting right off to elect Principal Williams, or any particular man, to the office. The main question was, Did they want a permanent veterinary surgeon?

The Chairman stated what the action of the Directors had been after the lamented death of Principal Williams. They had to consider the course they should pursue. It was remitted to the Finance Committee to discuss the matter in all its bearings. The report that Committee submitted was a recommendation that it was not advisable at the present time to make any appointment, and that the better plan was that to appoint veterinary surgeons for each Show, not necessarily in the district of the Show, and when any question arose requiring the special consideration of the Society, to employ the very best veterinary advice they could obtain. This recommendation was unanimously adopted by the Directors on 6th March 1901, and they had acted on it last year, employing for the Show the services of leading veterinary surgeons in the district, and being advised on questions as they arose by the very best men in their respective departments. They considered that for the present they were in a much better position to have thus a free hand to consult any one than in having a permanent official, by whose advice they would require to be guided. On behalf of the Directors he had just to say that the view that they had taken in March 1901 still commended itself to them.

Mr James Shields moved that the whole question be remitted to the Directors with full powers.

Mr Gemmell seconded.

Mr A. M. Gordon, supplementing the Chairman's remarks, said he thought Mr Johnston had over-stated his case. He seemed to say that cattle came to the Highland Show from all parts of the globe, and he had at the same time rather complained that the Canadian cattle were shut out. He would leave him to reconcile these statements himself. The Directors had very carefully considered the question when it was put before them in March 1901, and they had arrived at their conclusions unanimously, that it was better to do as they had done. They could employ the very best man who was best fitted to carry out any inquiry they might have in hand. In coming to this decision they expressed no opinion as to whether Principal Owen Williams might not be that man, but he was convinced that they were doing rightly in not at the time appointing a permanent veterinary surgeon, and he was certain that that common-sense view would commend itself to a common-sense assembly such as that before him.

On a vote the amendment of Mr Shields was carried by a large majority.

Mr Johnston had a motion on the paper proposing alterations in the arrangements for the nomination of Directors, but by leave of the meeting he withdrew it.

DISTRICT SHOWS.

Mr WALTER ELLIOT submitted the report on district competitions, showing that in 1901 grants of money and medals have been given in 296 districts. The total expenditure under this head amounted to £452. For the current year the Directors proposed the following grants: (1) Under section 1—Eighteen districts for grants of £12 each for cattle, horses, and sheep, and eight districts in intermediate competition with a grant of three silver medals to each; (2) under section 2—twelve districts for grants of £15 each for stallions; special grants of £40 for Highland home industries; £20 to Kilmarnock Cheese Show; £5 to Shetland; and £3 each to Orkney, East Mainland, West Mainland, and Sanday, Orkney; thirty districts for two medals each; the usual medals at ploughing competitions; and sixteen districts for two medals each for cottages and gardens—making the total sum offered in 1902 £588, against £452 awarded in 1901.

Approved.

SCIENCE—IMPROVEMENT OF UPLAND PASTURES.

Mr W. S. FERGUSON reported that the experiment carried on jointly by the Society and the West of Scotland Agricultural College, with the assistance of the Board of Agriculture, whose object is the improvement of upland pastures and the measurement of the success attending the means employed by noting the increase of the number of sheep the various plots are able to carry, and the quality of the mutton produced, has now passed the preliminary stage, and that the results have justified the opinion of the Committee that a preliminary gauging of the natural fertility of each plot on each of the three stations was not only expedient, but essential to the success of the experiment. At each of the three stations—Boon, Sunderland Hall, and Naemoor—20 acres have been fenced off, and divided into five plots of 4 acres each. They have been grazed by sheep during the past summer, and these have been regularly weighed at proper intervals, with the anticipated result that considerable differences in the productiveness of the various plots had been detected. Had the Committee begun to treat the plots in various ways without this preliminary year's grazing, during which the plots had nothing done to them, the differences due to the natural fertility of the plots would have been regarded as due to the different treatment they had received, and the results could only have been misleading. The treatment the plots are now to undergo is the following: One plot will be left in its natural state as a blank experiment to serve as a gauge for the remainder. One plot will have fed upon it a certain amount of oilcake, and on the remaining three plots there will be applied basic slag, basic slag and kainit, and lastly, superphosphate, preceded by an application of lime. These are the top-dressings which, in the opinion of the combined Committee of the Society, the College, and the Board of Agriculture, are most suitable to apply, and likely to elicit the most useful information. The experiments are under the immediate charge of local committees familiar with the farming of the districts, and interested in the investigation.

Professor WALLACE raised some questions regarding the experiments on Tibbers.

Dr GILLESPIE explained that the Tibbers experiment was under the charge of the West of Scotland Agricultural College, and he asked gentlemen to suspend their judgment until the experiments had reached a stage at which it was possible to form a judgment.

EDUCATION.

Dr GILLESPIE reported that at the examination held at the Dairy Institute, Kilmarnock, in the first week of October last, for the national diploma in Dairying, there were eleven candidates, of whom two obtained the diploma. The next examination in Scotland will take place, as last year, at the Dairy Institute, Kilmarnock, on Monday, 29th September, and three following days. The Directors recommended that a grant of £60 be given for the current year to the Glasgow and West of Scotland Agricultural College, in aid of the expenses in conducting the Kilmarnock Dairy School. He also reported that the next examination for the national diploma in Agriculture would be held, as last year, at the Yorkshire College, Leeds, on Monday, 5th May, and three following days. He congratulated the meeting and agriculturists generally on the equipment of the three agricultural colleges in Scotland—at Glasgow, Edinburgh, and Aberdeen. These were now in a position to give excellent instruction to as many students as chose to attend them, but he put great stress on the extension work in connection with these colleges at different centres throughout the country. There was a great drawback in the absence of acquaintance with the elements of agriculture amongst the students who attended these extension lectures. Under the Code which had now been superseded a large number of special classes in agriculture had been conducted in rural schools. In his own county of Dumfries out of 45 parishes 28 had conducted such classes. Under the new Code agricultural and

other special subjects had been withdrawn, and agriculture was now included under what was called nature knowledge. He was very much afraid that this meant that it was shelved altogether, and he hoped that meeting, and agriculturists everywhere, would support the Highland and Agricultural Society, and every other effort made to get instruction in the elements of agriculture imparted in rural schools.

Entomologist's Report.

The annual report from the Society's Entomologist, Dr R. S. MacDougall, stated that a good many complaints of insect attacks had been received during the past year, the fine weather having favoured the development and multiplication of insect life. Attacks by the following insects were investigated and reported upon—viz.: (1) On agricultural crops—diamond-backed moth, turnip moth, and the granary weevil; (2) on fruit and fruit-trees—strawberry beetle, raspberry moth, apple blight, and the small ermine moth; (3) on trees—the pine beetle, the pine weevil, the pine tortrix moth, the larch moth, and the wood wasp. Dr MacDougall continued his investigations regarding the disease which did so much damage amongst swedes two years ago, especially in the south-west of Scotland. He has proved that the disease is caused by bacteria. From cultures prepared from diseased plants he has experimentally produced the disease in healthy turnips. Although the bacteria are not able to invade a perfectly sound turnip, they gain entrance by a wound, such wound being in many cases caused by insect attack. In turnips grown in three widely separated districts, Dr MacDougall found at work grubs which, on being fed and bred up to the adult stage, produced flies, which, so far, remain undetermined. They are certainly new to us in Britain, and, it is believed, may be new to science.

Professor Wallace asked whether it would not be well for the Society's entomologists to give attention to the question whether this disease might not be imported in the seed? He was confident from investigations that it had been imported in that way. His idea was that it was imported in foreign seed about sixteen years ago, and lurked in out-of-the-way corners to a greater extent than perhaps farmers were aware of. He hoped this would receive the attention of the Society.

Forestry.

Sir Robert Menzies moved that the grant of £50 to the Lecturer on Forestry in the Edinburgh University be continued for the current year. He also reported that the next examination for the Society's certificate in Forestry would be held, in accordance with the new regulations, in April 1903.

Publications.

Dr Gillespie reported that the volume of the 'Transactions' for the current year was now being prepared, and would be issued to members in March.

APPENDIX

PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND IN 1902

CONTENTS.

GENERAL NOTICE.

THE HIGHLAND SOCIETY was instituted in the year 1784, and incorporated by Royal Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have since been continuously directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising the Society to grant Diplomas to Students of Agriculture; and by giving grants in aid of education in Agriculture and allied sciences. In 1900 the Society discontinued its own Examination, and instituted jointly with the Royal Agricultural Society of England an Examination for a National Diploma in Agriculture.

4. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practise. Now terminated in accordance with arrangements with the Royal College of Veterinary Surgeons.

5. The institution of a National Examination in Dairying, jointly with the Royal Agricultural Society of England.

6. The institution of an Examination in Forestry for First and Second Class Certificates.

7. The appointment of a chemist for the purpose of promoting the application of science to agriculture, and to superintend local experiments.

8. The establishment of a Botanical Department.

9. The appointment of Entomologist to advise members regarding insect pests.

10. The annual publication of the 'Transactions,' comprehending papers by selected writers, Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.

11. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society), to assist young natives of the Highlands who enter His Majesty's Navy.

CONSTITUTION AND MANAGEMENT.

The general business of THE HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of the Royal Charters, referred to above, which authorise the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers.

The Supplementary Charter of 1856 provides for the appointment of a Council on Education, consisting of Sixteen Members — Nine nominated by the Charter and Seven elected by the Society.

PRIVILEGES OF MEMBERS

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. *To receive a free copy of the 'Transactions' annually.*
2. *To apply for District Premiums that may be offered.*
3. *To report Ploughing Matches for Medals that may be offered.*
4. *To Free Admission to the Shows of the Society.*
5. *To exhibit Live Stock and Implements at reduced rates.*[1]
6. *To have Manures and Feeding-Stuffs analysed at reduced fees.*
7. *To have Seeds tested at reduced fees.*
8. *To have Insect Pests and Diseases affecting Farm Crops inquired into.*
9. *To attend and vote at General Meetings of the Society.*
10. *To vote for the Election of Directors, &c., &c.*

ANALYSIS OF MANURES AND FEEDING-STUFFS

The Fees of the Society's Chemist for Analyses made for Members of the Society shall, until further notice, be as follow :—

The estimation of *one* ingredient in a manure or feeding-stuff	5s.
The estimation of *two or more* ingredients in a manure or feeding-stuff . . .	10s.

These charges apply only to analyses made for the sole and private use of Members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed

The Society's Chemist, if requested, also supplies valuations of manures, according to the Society's scale of units.

SEEDS, CROP DISEASES, INSECT PESTS, &c.

The rates of charges for the examination of plants and seeds, crop diseases, insect pests, &c., will be found on pages 34 and 35.

ELECTION OF MEMBERS

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

CONDITIONS OF MEMBERSHIP

The ordinary annual subscription is £1, 3s. 6d., and the ordinary subscription for life-membership is £12, 12s.; or after ten annual payments have been made, £7, 7s. Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, are admitted on a subscription of 10s. annually, which may be redeemed by one payment of £5, 5s., or, after ten annual payments have been made, by one payment of £3, 3s.[2] Subscriptions are payable on election, and afterwards annually in January.

Members are requested to send to the Secretary the names and addresses of Candidates they have to propose (stating whether the Candidates should be on the £1, 3s. 6d. or 10s. list).

JAMES MACDONALD, *Secretary.*

3 GEORGE IV BRIDGE, EDINBURGH.

[1] Firms are not admitted as Members; but if one partner of a firm becomes a Member, the firm is allowed to exhibit at Members' rates.

[2] Candidates claiming to be on the 10s. list must state under which of the above designations they are entitled to be placed on it.

ESTABLISHMENT FOR 1901-1902

President.

THE EARL OF ABERDEEN, Haddo House, Methlick

Vice-Presidents.

The Earl of Kintore, Inglismaldie, Laurencekirk.
Lord Saltoun, Philorth, Fraserburgh.
James Campbell, Old Cullen, Cullen.
Andrew Hutcheson, Beechwood, Perth.

Ordinary Directors.

Year of Election.	
1898	E. Hedley Smith, B.L., Whittinghame, Prestonkirk.
	William Clark, Netherlea Farm, Cathcart.
	Sir Alan H. Seton-Steuart of Touch, Bart., Stirling.
	W. S. Ferguson, Pictstonhill, Perth.
	R. Shirra Gibb, Boon, Lauder.
	R. W. B. Jardine, yr. of Castlemilk, Lockerbie.
	Alexander M. Gordon of Newton, Insch, Aberdeenshire.
	J. Douglas Fletcher of Rosehaugh, Avoch, R.S.O., Ross-shire.
1899	R. Sinclair Scott, Burnside, Largs.
	Sir Robert D. Moncreiffe of Moncreiffe, Bart., Bridge of Earn.
	John Murray, Munnieston, Kippen Station, Stirling.
	Sir Archibald Buchan Hepburn of Smeaton, Bart., Prestonkirk.
	John Marr, Cairnbrogie, Old Meldrum.
	Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O.
	C. M. Cameron, Balnakyle, Munlochy.
	C. H. Scott Plummer of Sunderland Hall, Selkirk.
1900	William Taylor, Park Mains, Renfrew.
	F. W. Christie, Dairsie Mains, Cupar-Fife.
	David Wilson of Carbeth, Killearn.
	John M'Hutchen Dobbie, Campend, Dalkeith.
	Thomas Gordon Duff of Drummuir, Keith.
	Robert F. Dudgeon of Cargen, Dumfries.
	John Macpherson Grant, Old Milton, Kingussie.
	John Wilson, Chapelhill, Lauder Road, Edinburgh.
1901	St Clair Cunningham, Hedderwick Hill, Dunbar.
	Alexander Cross of Knockdon, 19 Hope Street, Glasgow.
	A. H. Anderson, Kippendavie Estate Office, Dunblane.
	The Earl of Mansfield, Scone Palace, Perth.
	Charles J. Cunningham, Wooden, Kelso.
	John M'Caig, Challoch, Leswalt.
	William Duthie, Tarves, Aberdeenshire.
	John Cran, Kirkton, Bunchrew, Inverness.

Extraordinary Directors.

1901 {
JOHN FLEMING, Lord Provost of Aberdeen.
Hon CHARLES FORBES TREFUSIS, Fettercairn House, Fettercairn.
Sir DAVID STEWART of Banchory, Banchory House, Aberdeen.
GARDEN A. DUFF of Hatton, Hatton Castle, Turriff.
JOHN FINDLAY of Aberlour, 3 Rothesay Terrace, Edinburgh.
CHAS. E. N. LEITH HAY of Leith Hall, Kennethmont, Aberdeenshire.
GEORGE SMITH GRANT of Auchorachan, Glenlivet.
JAMES HAY, Little Ythsie, Tarves.
DAVID HUME, Barrelwell, Brechin.
GEORGE J. WALKER, 3 Golden Square, Aberdeen.

1899 {
Sir RALPH ANSTRUTHER of Balcaskie, Bart., Pittenweem.
GEORGE R. GLENDINNING, Hatton Mains, Kirknewton.
ROBERT PATERSON, Hill of Drip, Stirling.

1900 {
WALTER ELLIOT, Hollybush, Galashiels.
Sir ROBERT MENZIES of Menzies, Bart., Camserney, Aberfeldy.
JOHN SPEIR, Newton Farm, Newton, Glasgow.

1901 {
JONATHAN MIDDLETON, Clay of Allan, Fearn, Ross-shire.
CHARLES HOWATSON of Glenbuck, Glenbuck.
W. T. MALCOLM, Dunmore Home Farm, Larbert.
Captain D. G. CLAYHILLS HENDERSON of Invergowrie, R.N., Dundee.

Office-Bearers.

Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., *Treasurer*.
Sir JOHN GILMOUR of Montrave, Bart., *Honorary Secretary*.
JAMES MACDONALD, F.R.S.E., *Secretary*.
Rev. ARCHIBALD SCOTT, D.D., *Chaplain*.
ANDREW P. AITKEN, D Sc., 8 Clyde Street, *Chemist*
WILLIAM HOME COOK, C.A., 42 Castle Street, *Auditor*.
TODS, MURRAY, & JAMIESON, W.S., *Law Agents*.
A. N. M'ALPINE, 6 Blythswood Square, Glasgow, *Consulting Botanist*.
R. S. MACDOUGALL, M.A., D.Sc., 13 Archibald Place, *Consulting Entomologist*.
JOHN MACDIARMID, *Clerk*.
EDWARD M. COWIE, *Second Clerk*
WILLIAM BLACKWOOD & SONS, 45 George Street, *Printers and Publishers*.
KEITH & Co., 43 George Street, *Advertising Agents*.
G. WATERSTON & SONS, 35 George Street, *Stationers*.
THOMAS SMITH & SONS, 47 George Street, *Silversmiths*.
ALEXANDER KIRKWOOD & SON, 9 St James' Square, *Medallists*.
JOHN WATHERSTON & SONS, *Inspectors of Works*.
WILLIAM SIMPSON, *Messenger*.

Chairman of Board of Directors.

Sir RALPH ANSTRUTHER of Balcaskie, Bart.

Chairmen of Committees.

1. *Argyll Naval Fund* .	Captain G. D. CLAYHILLS HENDERSON.
2. *Finance, Chambers, and Law*	Sir JAMES H. GIBSON-CRAIG, Bart.
3. *Publications* . . .	Rev. JOHN GILLESPIE, LL.D.
4. *Shows*	Sir JAMES H. GIBSON-CRAIG, Bart.
5. *Science* . . .	DAVID WILSON of Carbeth.
6. *General Purposes* . .	Sir JAMES H. GIBSON-CRAIG, Bart.
7. *National Diplomas* . .	Rev. JOHN GILLESPIE, LL.D.
8. *Forestry* . . .	Sir ROBERT MENZIES, Bart.

COMMITTEES FOR 1901-1902

1. ARGYLL NAVAL FUND.

Capt. G. D. Clayhills Henderson of Invergowrie, R.N., Dundee, *Convener.*
Sir David Baird of Newbyth, Bart., Prestonkirk.
Sir Robert Menzies of Menzies, Bart., Camserney, Aberfeldy.
John Maclachlan of Maclachlan, 48 Castle Street, Edinburgh.

2. FINANCE, CHAMBERS, AND LAW.

Sir James H. Gibson-Craig of Riccarton, Bart., *Convener.*
The Earl of Mansfield, Scone Palace, Perth.
Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O.
G. R. Glendinning, Hatton Mains, Kirknewton.
Alexander Cross of Knockdon, 19 Hope Street, Glasgow.
A. M. Gordon of Newton, Insch, Aberdeenshire.
John M'Hutchen Dobbie, Campend, Dalkeith.
W. S. Ferguson, Pictstonhill, Perth.
Sir John Gilmour of Montrave, Bart., Hon. Secretary, *ex officio.*
William Home Cook, C.A., Auditor, *ex officio.*

3. PUBLICATIONS.

Rev. John Gillespie, LL D., Mouswald Manse, Ruthwell, R.S.O., *Convener.*
Dr A. P. Aitken, 8 Clyde Street, Edinburgh.
John Speir, Newton Farm, Newton, Glasgow.
David Wilson of Carbeth, Killearn.
R. Shirra Gibb, Boon, Lauder.
Sir Robert D. Moncreiffe of Moncreiffe, Bart., Bridge of Earn.
John M'Hutchen Dobbie, Campend, Dalkeith.

4. SHOWS.

Sir James H. Gibson-Craig of Riccarton, Bart., Currie, *Convener.*
Alex. M. Gordon of Newton, Insch, Aberdeenshire, *Vice-Convener.*
Sir Robert Menzies of Menzies, Bart., Camserney, Aberfeldy.
John Cran, Kirkton, Bunchrew, Inverness.
Walter Elliot, Hollybush, Galashiels.
Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O.
Sir John Gilmour of Montrave, Bart., Leven.
John Marr, Cairnbrogie, Old Meldrum.
Jonathan Middleton, Clay of Allan, Fearn.
R. Sinclair Scott, Burnside, Largs.
W. S. Ferguson, Pictstonhill, Perth.
Alex. Cross of Knockdon, 19 Hope Street, Glasgow.
W. T. Malcolm, Dunmore Home Farm, Larbert.
G. R. Glendinning, Hatton Mains, Kirknewton.

J. D. Fletcher of Rosehaugh, Avoch, R.S.O., Ross-shire.
C. M. Cameron, Balnakyle, Munlochy.
John Wilson, Chapelhill, Lauder Road, Edinburgh.
William Duthie, Tarves, Aberdeenshire.
Robert F. Dudgeon of Cargen, Dumfries.
John M'Hutchen Dobbie, Campend, Dalkeith.
John M'Caig, Challoch, Leswalt.
R. W. B. Jardine, yr. of Castlemilk, Lockerbie.
William Clark, Netherlea Farm, Cathcart.
E. Hedley Smith, B.L., Whittinghame, Prestonkirk.
Sir Robert D. Moncreiffe of Moncreiffe, Bart., Bridge of Earn.
John Murray, Munnieston, Kippen Station, Stirling.
William Taylor, Park Mains, Renfrew.
F. W. Christie, Dairsie Mains, Cupar-Fife.
A. H. Anderson, Kippendavie, Dunblane.
Charles Howatson of Glenbuck, Glenbuck.
St Clair Cunningham, Hedderwick Hill, Dunbar.
Charles J. Cunningham, Wooden, Kelso.

5. SCIENCE.

David Wilson of Carbeth, Killearn, *Convener*.
Jonathan Middleton, Clay of Allan, Fearn, Ross-shire, *Vice-Convener*.
The Earl of Mansfield, Scone Palace, Perth.
G. R. Glendinning, Hatton Mains, Kirknewton.
R. Shirra Gibb, Boon, Lauder.
W. S. Ferguson, Pictstonhill, Perth.
John Speir, Newton Farm, Newton, Glasgow.
Andrew Hutcheson, Beechwood, Perth.
Alex. Cross of Knockdon, 19 Hope Street, Glasgow.
Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O.
John Wilson, Chapelhill, Lauder Road, Edinburgh.
Sir John Gilmour of Montrave, Bart., Leven, Fife.
Sir Ralph Anstruther of Balcaskie, Bart., Pittenweem.
John M'Hutchen Dobbie, Campend, Dalkeith.
John M'Caig, Challoch, Leswalt.
E. Hedley Smith, B.L., Whittinghame, Prestonkirk.
Captain Clayhills Henderson of Invergowrie, R.N., Dundee.
Dr Aitken, Chemist, *ex officio*.
A. N. M'Alpine, Botanist, *ex officio*.

6. GENERAL PURPOSES.

Sir James H. Gibson-Craig of Riccarton, Bart., Currie, *Convener*.
The Earl of Mansfield, Scone Palace, Perth.
G. R. Glendinning, Hatton Mains, Kirknewton.
Alex. M. Gordon of Newton, Insch, Aberdeenshire.
Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O.
John M. Martin, 5 Drummond Place, Edinburgh.
John M'Hutchen Dobbie, Campend, Dalkeith.
Sir John Gilmour of Montrave, Bart., Leven, *ex officio*.

7. NATIONAL DIPLOMAS.

Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, R.S.O., *Convener*.
Alex. Cross of Knockdon, 19 Hope Street, Glasgow.
John Speir, Newton Farm, Newton, Glasgow.
David Wilson of Carbeth, Killearn.
James Macdonald, *Secretary*.

8. FORESTRY.

Sir ROBERT MENZIES of Menzies, Bart., Camserney Cottage, Aberfeldy, *Convener.*
EARL OF STAIR, K.T., Lochinch, Castle-Kennedy Station.
The MASTER OF POLWARTH, Humbie House, Upper Keith.
Sir JOHN GILMOUR of Montrave, Bart., Leven.
A. M. GORDON of Newton, Insch, Aberdeenshire.
R. C. MUNRO FERGUSON of Raith, M.P., Kirkcaldy.
JOHN METHVEN, 15 Princes Street, Edinburgh.
Colonel F. BAILEY, 7 Drummond Place, Edinburgh.
WILLIAM DUNN, Kenmore, Aberfeldy.
DAVID KEIR, Ladywell, Dunkeld.
JOHN MICHIE, Balmoral, Ballater.
A. PITCAITHLEY, Jeanie Bank, Old Scone, Perth.

The President, Vice-Presidents, the Treasurer, Honorary Secretary, and Chairman of Directors are members *ex officiis* of all Committees.

MEETINGS.

General Meetings.—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held in the months of January and June, in the Society's Hall, 3 George IV. Bridge, for the election of Members and other business. Twenty a quorum.

By a resolution of the General Meeting on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual Show. This year it will be held at Aberdeen, on Wednesday, 16th July, at an hour to be announced in the programme of the Show.

With reference to motions at General Meetings, Bye-Law No. 10 provides—"That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

General Show at Aberdeen—15th, 16th, 17th, and 18th July.—Entries close for Implements, 12th May; Stock, Poultry, and Dairy Produce, 9th June.

Directors' Meetings.—The Board of Directors meet (except when otherwise arranged) on the first Wednesday of each month from November till June inclusive, at half-past one o'clock P.M., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Seven a quorum.

Nomination of Directors.—Meetings of Members, for the purpose of nominating Directors to represent the Show Districts on the Board for the year 1902-1903, will be held at the places and on the days after mentioned:—

1. Edinburgh, 3 George IV. Bridge, .	Wednesday, 12th Feb., at 2.
2. Glasgow, North British Station Hotel,	Wednesday, 19th Feb., at 1.
3. Stirling, Golden Lion Hotel, . .	Friday, 21st Feb., at 1.30.

4. Perth, Salutation Hotel, . . . Friday, 28th February, at 2
5. Kelso, Cross Keys Hotel, . . . Friday, 7th March, at 12.30.
6. Dumfries, King's Arms Hotel, . . Wednesday, 12th March, at 1
7. Aberdeen, Imperial Hotel, . . . Friday, 14th March, at 2.
8. Inverness, Station Hotel, . . . Tuesday, 18th March, at 12.30.

The nomination of Proprietors or other Members paying the higher subscription must be made in the 3rd, 6th, 7th, and 8th Districts; and the nomination of Tenant-Farmers or other Members paying the lower subscription, in the 1st, 2nd, 4th, and 5th Districts.

Committee Meetings.—Meetings of the various Committees are held as required.

EXAMINATIONS.

Agriculture.—The Examination for 1902 for the National Diploma in Agriculture will be held at the Yorkshire College, Leeds, on Monday, 5th May, and three following days. Entries close on Saturday, 29th March.

Forestry.—The next Examination for the Society's Certificates in Forestry will be held in April 1903.

Dairy.—The Examination for 1902 for the National Diploma in Dairying will be held at the Kilmarnock Dairy School, on Monday, 29th September, and three following days. Entries close on 30th August.

AGRICULTURAL EDUCATION

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

From 1858 to 1899 the Society held an annual Examination for Certificate and Diploma in Agriculture, winners of the Diploma (F.H.A.S.) being elected Free Life Members of the Society.

In 1898 it was resolved by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland to discontinue the independent Examinations in Agriculture held by the two Societies, and to institute in their stead a Joint-Examination for a NATIONAL DIPLOMA IN AGRICULTURE (N.D.A.) This Examination is now conducted under the management of the "National Agricultural Examination Board" appointed by the two Societies. The following are the Members of this Board appointed by the Highland and Agricultural Society for the current year, viz.:—

Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
DAVID WILSON of Carbeth, Killearn.
ALEXANDER CROSS of Knockdon, 19 Hope Street, Glasgow.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
JAMES MACDONALD, *Secretary*.

REGULATIONS AND SYLLABUS OF THE EXAMINATION FOR THE NATIONAL DIPLOMA IN THE SCIENCE AND PRACTICE OF AGRICULTURE.

REGULATIONS.

1. The Societies may hold conjointly, under the management of the National Agricultural Examination Board appointed by them, an annual Examination in the Science and Practice of Agriculture, at a convenient centre.

2. Candidates who pass the Examination will receive the National Diploma in Agriculture—the Diploma to be distinguished shortly by the letters "N.D.A."

3. The Examination will be conducted by means of written papers and oral Examinations.

4. The Examination must be taken in Two Parts as follows:—

First Part.	*Second Part.*
1. Mensuration and Land Surveying.	6. Practical Agriculture.
2. Agricultural Botany.	7. Agricultural Book-keeping.
3. General Chemistry.	8. Agricultural Chemistry.
4. Geology.	9. Agricultural Engineering.
5. Agricultural Entomology.	10. Veterinary Science.

5. The maximum number of marks obtainable and the minimum number of marks in each subject qualifying for the Diploma will be as follows:—

First Part—

Subject	Max. No. of Marks.	Pass Marks for Diploma.
1. Mensuration and Land Surveying	200	120
2. Agricultural Botany	200	120
3. General Chemistry	100	60
4. Geology	100	50
5. Agricultural Entomology	100	50
Second Part—		
6. Practical Agriculture	500	300
7. Agricultural Book-keeping	200	120
8. Agricultural Chemistry	200	120
9. Agricultural Engineering	200	120
10. Veterinary Science	100	50

6. A Candidate who obtains not less than three-fourths (1425) of the aggregate maximum marks (1900) in the entire Examination will receive the Diploma with Honours, provided (*a*) that he passes each of the two Parts of the Examination at the first attempt, and (*b*) that he obtains not less than three-fourths (375) of the maximum marks (500) in the subject of Practical Agriculture.

7. A Gold Medal will be awarded to the Candidate on the Honours List who obtains the highest number of total marks in the whole Examination.

8. A Candidate will not be entitled to take both Parts of the Examination at one time. A year at least must elapse between the passing of the First Part and sitting for the Second Part; and the Second Part must, except with the special permission of the Board, be taken within two years of the passing of the First Part.

9. A deposit of £1 will be required from each Candidate for each Part of the Examination. This deposit will be returned only to those who at the first attempt obtain Pass marks in all the subjects included in that Part. The Board may at their discretion allow an unsuccessful Candidate to sit for one subsequent Examination in the same Part without payment of a further deposit.

10. A Candidate who fails to obtain Pass marks in any of the subjects in the Part for which he is sitting must take the entire Part again.

11. Holders of both the First Class Certificate of the Royal Agricultural Society of England and the Diploma of the Highland and Agricultural Society of Scotland will not be eligible for this Examination; holders of only one of these distinctions may enter for this Examination in 1902.

12. The Board reserve the right to postpone, abandon, or in any way, or at any time, modify an Examination, and also to decline at any stage to admit any particular Candidate to the Examination.

The Examination of 1902 will take place in the Great Hall of the Yorkshire College, Leeds, on Monday, 5th May 1902, and following days. Forms of application for permission to sit at the Examination may be obtained from either of the undersigned, and must be returned duly filled up not later than Monday, the 31st March 1902, when the Entries will close.

By Order,

ERNEST CLARKE,
Secretary, Royal Agricultural Society of England,
13 Hanover Square, London, W.

JAMES MACDONALD,
Secretary, Highland and Agricultural Society of Scotland,
3 George IV. Bridge, Edinburgh.

SYLLABUS OF SUBJECTS OF EXAMINATION.

FIRST PART.

I.—AGRICULTURAL BOTANY.

1. *Morphology.*—The structure of plants. The principles of classification. The Natural Orders (Phanerogams and Cryptogams) dealing specially with those of importance to the Agriculturist.

2. *Physiology.*—The life of the plant. Organs and their functions—nutritive and reproductive.

3. *Pathology.*—Diseases of plants, and their causes. Parasites—Phanerogams, Fungi, Bacteria. Prevention and cure.

4. *Cultivation.*—Conditions in plant life favourable to (*a*) the improvements of cultivated plants, and (*b*) the destruction of weeds. New varieties of plants. Pastures. Pruning.

N.B.—*Candidates will be required to identify plants usually found on a farm.*

II.—MENSURATION AND LAND SURVEYING.

1. Ordinary rules of superficial and solid mensuration. Volume of a prismoid. Applications to practical questions. Estimation of weights of bodies whose dimensions and specific gravity are known.

2. Land surveying by chain. Plotting from field-book, and determination of areas surveyed. The simpler "field problems."

3. The use and adjustment of instruments employed in Surveying and Levelling.

4. Levelling and plotting from field-book.

5. A sufficient knowledge of Trigonometrical Surveying for the determination of heights and distances by Theodolite; as essential to this, solution of plane triangles by the aid of Logarithmic Tables.

6. A knowledge of the various classes of maps published by the Ordnance Survey Department and their Scales.

N.B.—*Each candidate should have with him at the Examination a pair of compasses, scales of equal parts, including a scale of one chain to an inch, and the scale fitting the Ordnance map,* $\frac{1}{2500}$, *or* 25·344 *inches to the mile, a small protractor, a set square, and a straight-edge about* 18 *inches in length.*

III.—GENERAL CHEMISTRY.

1. *The Chemical Elements.*—Definition and classification of elements. Occurrence in nature and leading characters of the elements most commonly met with.

2. *Common Chemical Compounds.*—Preparation and properties of common products of inorganic chemistry (such as the mineral acids, alkalies, salts, &c.)

3. *Laws and Theory.*—The laws of chemical combination. Explanation of equivalence. Distinction of chemical and mechanical compounds. Laws of gaseous diffusion. The atmosphere. Theory of combustion.

4. *Analysis.*—Qualitative and quantitative analysis of atmospheric air. Quantity of air required in combustion. Qualitative analysis of common inorganic substances. Quantitative analysis in simple cases (such as the determination of strength of solutions, proportions of acids and bases in simple salts) by volumetric and gravimetric methods. Ultimate organic analysis by combustion. Proximate analysis by solvents; dialysis and fractional distillation.

5. *Carbon Compounds.*—Ordinary alcohol and ether, and the most common ethylic salts. Oxalic acid, lactic acid, acetic acid and its homo-

logues, fats, glycerine, and soap. Paraffins. Phenol. Cyanogen and its most common compounds, urea, and uric acid. Saccharine and amylaceous compounds. Turpentine and resin. Tannin. Albumen. Gelatine. Fermentation.

N.B.—*In this section exact knowledge of general principles and typical compounds is expected, rather than diffuse information.*

IV.—GEOLOGY.

1. Chief minerals entering into the composition of rocks. Origin and composition of aqueous and igneous rocks. General principles of the classification of rocks. Leading divisions of the stratified rocks, and their geographical distribution in the British Islands.
2. Stratification, cleavage, and faulting of rocks.
3. Influence of the geological structure of a country on the configuration of the land and the composition of the soil. Relation of Strata to water-supply and drainage. Origin of springs.
4. The various mineral manures, their sources, characters, and mode of occurrence.
5. Different kinds of building-stones and road materials. Distribution of the various economical substances.

N.B.—*Candidates will be required to name and describe common rocks, minerals, and fossils.*

V.—AGRICULTURAL ENTOMOLOGY.

1. The position of Insects in the Animal world, with the characters that mark them out from related animal groups.
2. *General Structure of Insects.*—Head, Thorax, Abdomen, Alimentary Canal, Circulation, Respiratory System, Nervous System and Sense Organs. Reproductive System.
3. *Metamorphosis of Insects*, with the economic importance of the different stages.
4. *Classification of Insects.*—The general characters of the following Natural Orders: Coleoptera, Lepidoptera, Hymenoptera, Diptera, Hemiptera, Orthoptera, Neuroptera.
5. *Larvæ.*—Their varying forms as a help to identification.
6. The *Life-history* of the Insects, Worms, and Acarines injurious to Food Crops generally and to Live Stock. Recognition of the common pests by external characters and by their work.
7. Insects useful in Agriculture.
8. Circumstances favouring Insect increase. Farm practice in relation to the discouraging of Insect attack.
9. *Preventive and Remedial Measures.*—Encouragement of Insect-eating birds and mammals. Fungoid diseases of Insects. Artificial remedies. Insecticides and their composition and preparation.

N.B.—*Practical acquaintance with common insects, worm parasites, &c., will be expected. Where the Candidate is not acquainted with the scientific name of an Insect, the generally received English name will be accepted.*

SECOND PART.

VI.—PRACTICAL AGRICULTURE.

1. *Soils.*—Classification of soils—characters and composition—suitability for cultivation.
2. *Improvement of Soil.*—Drainage, Irrigation, and Warping. The application of lime—marl—clay—ashes, &c.

3. *Rotations.*—The principles of rotations—rotations suitable for different soils and climates—systems of farming.

4. *Manures.*—The properties of manures—general and special—amounts used per acre—period and mode of application—treatment and disposal of sewage.

5. *Food-stuffs.*—The properties of feeding substances—their suitability for different classes of farm stock—considerations affecting their use—rations for different classes of stock.

6. *Crops.*—Farm crops (cereals, agricultural grasses and clovers, forage plants and roots). How they grow—their cultivation, including cleaning, harvesting, and storage--diseases—insect injuries and remedies.

7. *Weeds and Parasitic Plants.*—Best methods of eradication.

8. *Pests of the Farm.* -Injuries to crops and live stock of the farm due to mammals, birds, and insects, with their prevention and remedies.

9. *Weather.*—Meteorology, or the effect of climate on farming conditions.

10. *Live Stock.*—The breeding, rearing, feeding, and general treatment of farm stock—the different breeds of horses, cattle, sheep, pigs, and poultry—their characteristics—the districts where they are generally met with.

11. *Milk.*—The production and treatment of milk—the manufacture of cheese, butter, &c.—the utilisation of bye-products.

12. *Machinery.*—The uses and prices of the machines and implements used in farming in different parts of Great Britain.

13. *Buildings.*—Buildings required on different classes of farms in various districts.

14. *Farming Capital.*—Calculations of the cost of stocking and working arable, stock, and dairy farms. Farm valuations. Rent, taxes, and cost of labour.

N.B.—*It is essential that a Candidate know his subject practically, and that he satisfy the Examiner of his familiarity with farm routine. Candidates will be expected to illustrate their answers when necessary by intelligible sketches or diagrams.*

VII.—AGRICULTURAL BOOK-KEEPING.

1. Agricultural Book-keeping—Description of books to be kept, with examples.
2. Valuation of stock and effects.
3. Profit and Loss, and Balance Sheet.

VIII.—AGRICULTURAL CHEMISTRY.

1. *Soil.*—The origin, formation, and classification of soils. The constituents of soils. The supply of plant-food by the soil. The chemical and physical properties of soils of different kinds. The adaptation of soils to particular crops. The relations of air and water to soils. Nitrification and the biology of the soil. The chemical and physical effects of tillage operations and drainage. The improvement of soils. Causes of infertility. Mechanical and chemical analysis of soils.

2. *Plant-life.*—The constituents of plants. The relations of atmosphere, rainfall, heat, and light to vegetation. The sources of plant-food.

3. *Manures.*—The supply of plant-food by manure. The improvement of the soil by manuring. The classification of manures as regards their composition, nature, and use. The manures in general use upon the farm. Farmyard manure and other natural manures. Green-manuring. Liming, marling, claying. Artificial manures, their origin and manufacture. The changes which manures undergo in the soil. The influence

of drainage. The application of manures. The analysis of manures. The adulteration of manures.

4. *Crops.*—The composition of the principal farm crops. Characteristics of particular kinds of crops. The influence of climate and season. The manuring of particular crops. The changes that take place in crops during the various stages of their growth. Rotation of crops.

5. *Foods.*—The constituents of foods, and their functions. The nutritive value and digestibility of foods. The chemical composition and use of the principal feeding-stuffs employed on the farm, and the sources of their supply. The main facts regarding respiration and digestion. The relation of foods to the production of work, meat, milk, and manure. The adaptation of foods to special requirements. The residual manurial value of foods, and the circumstances affecting it. The estimation of unexhausted fertility. Analysis and adulteration of foods.

6. *Water.*—Rain-water. Hard and soft waters. Drinking waters. Irrigation and sewage.

7. *Dairying.*—The composition of milk, and the conditions which influence its quality and supply. Cream and cream-separation. Butter and butter-making. Cheese and cheese-making. The influence of ferments on milk and milk products. The preservation of milk. Milk-testing.

IX.—AGRICULTURAL ENGINEERING.

1. *Heat.*—Nature of heat; thermometer; absolute zero; specific heat; latent heat; the unit of heat. Total heat of water; as ice, water, and steam. Conduction, convection, and radiation of heat. Mechanical equivalent of heat. Principle of combustion. Quantity of heat generated by combustion. Modes of transforming heat of combustion into power, as in the steam-engine, and gas and oil engine.

2. *Air.*—Properties of air; elasticity, specific heat. Barometer. Moisture. Movement. Winds. Windmills.

3. *Water.*—Composition. Weight. Height of column to balance atmosphere. Flow of water. Friction of water in pipes and channels. Usual speed of flow. Power derived from falls of water. Water-wheels; turbines; water-pressure engines; pumps. Potable water. Sources of supply. Means of purification. Storage.

4. *Mechanics.*—Centre of gravity; stability of structures. The lever; toothed wheels; pulleys and ropes; wrapping connectors; winches; differential pulleys. Laws of motion. Strength of materials, tensile, compressive, torsional, and transverse; elastic limit; ultimate strength. Work; horse-power; animal and human power. Friction of surfaces and axles; lubrication.

5. *Steam-engine.*—Construction of an ordinary portable-engine boiler, of a Cornish boiler, and its setting. Fittings of a boiler. Construction of the stationary and portable steam-engine. Single cylinder. Double cylinder. Compound. Slide-valve. Expansion valve. Cylinder. Piston-rod. Glands. Connecting-rod. Crank and crank shaft. Fly-wheel. Bearings. Pet cocks. Lubrication. Steam and fuel consumed per horse-power.

6. *Gas and Petroleum Engines.*—Principle of action. Construction of valve-gear. Sources of loss. Fuel and water required per horse-power.

7. *Electrical Generators, Motors, and Conductors.*—Principles of action—shunt; losses in electrical machinery. Efficiency. Detection of faults. Regulation of shunt and series motors. Use of fuses and cut-outs. Horse-power of motors, and calculation of Watts to be delivered at terminals. Ohm's law. Losses in conductors, and calculation of sizes to convey given currents with definite losses. Jointing and insulation of conductors.

8. *Construction of Agricultural Implements.*—The mode of action and the general principles involved in the construction of farm implements. The adjustments of implements for different descriptions of work. Lubrication. Working or wearing parts.

9. *Cultivating Implements worked by Steam Power.*

10. *Horse-cultivating Implements.*—Ploughs. Cultivators or Grubbers. Harrows. Rollers. Scrubbers, &c.

11. *Sowing Implements.*—Drills. Manure and water drills. Broadcast barrows. Broadcasters. Manure distributers. Potato planters, &c.

12. *Hoeing Implements.*—Horse-hoes. Scufflers.

13. *Securing of Crops.*—Reaping machines. Mowing machines. Haymakers. Horse-rakes. Elevators. Silage appliances. Potato raisers, &c.

14. *Carriages.*—Carts. Waggons. Sleighs. Rick-lifters, &c.

15. *Preparing Crops for Market.*—Threshing machines. Winnowing machines. Corn screens. Hummellers. Hay and straw presses, &c.

16. *Preparing Foods.*—Mills. Chaff-cutters. Pulpers. Turnip-cutters. Cake-breakers. Cooking apparatus.

17. *Dairy Appliances.*—Cream separators. Churns. Butter-workers. Cheese tubs. Curd mills. Cheese presses. Setting-pans. Refrigerators, &c.

18. *Land Improvement.*—Drainage instruments. Limekilns. Arrangements of shafting, pulleys, clutches, &c, for farm machinery at homesteads.

N.B.—*Marks will be given for neatness and accuracy of Drawing.*

X.—VETERINARY SCIENCE.

1. Anatomy and Physiology, including the comparative anatomy of the bones of the animals of the farm, and the structure and functions of the different organs and tissues of the horse, ox, sheep, and pig.

2. The digestive processes and principles of nutrition in the above animals.

3. A general knowledge of the blood and its circulation, and the processes of respiration, secretion, and excretion.

4. The physiology of reproduction, and its bearings on healthy breeding.

5. The period of gestation in the mare, cow, ewe, and sow, and the special management of these animals prior to, at the time of, and after parturition.

6. The management of farm stock in health and disease.

Past Examination Papers.

Copies of the Papers set at the Examination in 1901 may be had on application. Price 6d. per set.

VETERINARY DEPARTMENT

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become Members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of Students who passed for the Society's Certificate is 1183.

The Society votes annually eleven silver medals for Class Competition to each of the two Veterinary Colleges in Edinburgh, and to the one in Glasgow.

FORESTRY DEPARTMENT

The Society grants First and Second Class Certificates in Forestry.

In 1900 it was resolved that the examination in Forestry be held in 1901, and thereafter every alternate year.

Candidates must possess—1. A thorough acquaintance with the theory and practice of Forestry. 2. A general knowledge of the following branches of study, so far as these apply to Forestry: The Elements of Botany; The Elements of Physics, Chemistry, and Meteorology; Forest Entomology; Forest Engineering, including Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to fencing, draining, bridging, road-making, and saw-mills; Implements of Forestry; Book-keeping and Accounts.

The examinations are open to candidates of any age, will be both written and oral, and will include such practical tests as may from time to time be found convenient to apply.

The maximum number of marks for each subject is 100; First-Class marks in all subjects 75, Second-Class marks in all subjects 50, Pass marks in all subjects 40.

To obtain the *First-Class Certificate* a Candidate must have First-Class marks in Forestry and any two of the other subjects, and Pass in the two remaining subjects. To obtain the *Second-Class Certificate* a Candidate must obtain Second-Class marks in Forestry and in any two of the other subjects, and Pass in the two remaining subjects.

If a Candidate has obtained First-Class marks in Forestry and failed to obtain First-Class marks in only one or two of the other subjects, he can come up again for examination in these subjects alone for the *First-Class Certificate*, otherwise he must go through the entire examination again.

The list of students who obtained Certificates prior to 1899 appears in the 'Transactions,' Fifth Series, vol. xi. (1899).

The following obtained First-Class Certificates since the list was last published:—

Eric Arthur Nobbs, Edinburgh, ...	1899
George Potts, Whitchurworth, Trimdon Grange, Durham,	1899
Duncan S. Rabagliati, 1 St Paul's Road, Bradford, .	1901

The following obtained Second-Class Certificates since the list was last published :—

William Bruce, Buxton Cottage, Laurencekirk, .	.	1901
Rajappier Swaminathan, 56 Jesus Lane, Cambridge, .		1901
Thomas Usher, Courthill, Hawick,	. . . .	1901

SYLLABUS OF EXAMINATION

I.—SCIENCE OF FORESTRY AND PRACTICAL MANAGEMENT OF WOODS.

I. *Principles of Scientific Forestry.*—1. Effects of heat, light, moisture, and air-currents on forest vegetation. 2. Effects of depth, porosity, moisture, and chemical composition of the soil on forest vegetation. 3. Effects of forest vegetation on the soil and air. 4. Rate and extent of development, longevity, and reproductive power of trees. 5. Pure and mixed woods. 6. Systems of sylviculture.

II. *Practical Management of Woods.*—7. Draining and irrigation. 8. Choice of species for various situations. 9. Seed and sowing, including nurseries. 10. Planting. 11. Natural regeneration by seed, shoots, and suckers. 12. Formation of mixed woods. 13. Tending of young woods. 14. Pruning. 15. Thinning. 16. Sylvicultural characteristics of the principal trees.

III. *Injuries by Storms and Fires.*—17. Storms. 18. Fires.

IV. *Timber.*—19. Its technical properties. 20. Its defects. 21. Recognition of different kinds of timber. 22. Processes for increasing its durability.

V. *Utilisation of Produce.*—23. Uses of wood and other produce. 24. Felling. 25. Conversion. 26. Seasoning. 27. Transport. 28. Sales. 29. Harvesting of bark.

VI. *Forest Organisation.*—30. General ideas regarding a regulated system of forest management.

II.—FOREST BOTANY AND FOREST ZOOLOGY.

(*a*) Forest Botany.

The fundamental facts of morphology, physiology, and classification of plants. The structure and function of the plant-cell and the plant-tissues. Their primary distribution. The secondary changes they exhibit in consequence of perennation.

The structure and function of the root and shoot in flowering-plants. Buds, their forms and uses. The flower. The fruit. The seed.

The structure and function of vegetative and reproductive organs of fungi.

Relationship of plants to air, soil, and water. Effect of light, heat, and mechanical agencies upon plants. Nutrition. The nature and ele-

ments of the food of plants. Sources of plant-food. The absorption, elaboration, transference, and storage of food. Respiration and transpiration. Parasites and saprophytes. Symbiosis.

Growth of plants in length and thickness. Correlation of growth, pruning. Germination of seeds. Formation of wood and bark. Healing of wounds.

Diseases of plants due to faulty nutrition and unfavourable circumstances of growth. Diseases due to attacks of fungi.

Natural reproduction and propagation by seeds and by buds. Fertilisation of flowers. Hybridisation. Artificial propagation by budding, grafting, layering, and cutting.

The characters of the large groups and classes of the vegetable kingdom. The characters of the families of plants which include the chief timber trees. The botanical characteristics of the principal British forest-trees (including the structural features of their wood). The weeds of the forest and their significance.

(b) Forest Zoology.

The group Insecta its position in the animal kingdom. Structure, mode of reproduction, and metamorphosis of insects. The outlines of classification of the group. Conditions favourable to the numerical increase of insects. Natural checks to increase (*e.g.*, birds, mammals, parasitic insects). The identification and life-history of the more important insects injurious to forest-trees and fruit-trees. The damage caused by these insect pests and their mode of attack. The damage caused by animals. Preventive and remedial measures.

III.—PHYSICS, CHEMISTRY, AND METEOROLOGY.

Physics.

Mass, weight, specific gravity, solid, liquid, and gaseous states of matter. Capillarity, osmose, vapour tension, suction pump, force pump, syphon, barometer, atmospheric pressure. Boyle's law. Levers and pulleys. Heat, measurement of heat, specific heat; transference of heat by conduction, convection, and radiation. Boiling and freezing. Latent heat. The thermometer. The conservation and transformation of energy. Light—reflection, refraction, polarisation; the spectrum. The rudiments of electricity and magnetism.

Chemistry.

Elements. Oxygen, hydrogen, nitrogen;—their preparation, properties, and chief compounds. Acids, bases, salts. Combustion, oxidation, reduction. Sulphur, Carbon, Phosphorus; and their compounds, with oxygen and hydrogen. Metals—potassium, sodium, calcium, magnesium, aluminium, iron, copper, lead, mercury, and their chief compounds. Carbohydrates, marsh gas, olefiant gas, alcohol, acetic acid, oxalic acid. Distillation of wood and coal.

Meteorology.

The atmosphere, its composition and physical properties. Measurement of pressure and temperature. The barometer. Rain, hail, snow, fog, cloud, dew, the dew point, hoar frost. The weathering of rocks and soils. Gases injurious to vegetation.

IV.—FOREST ENGINEERING, INCLUDING LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, BRIDGING, ROAD-MAKING, AND SAW-MILLS.

1. The use of the level and measuring-chain. Measuring and mapping surface areas. 2. The measurement of solid bodies—as timber, stacked bark, fagots, &c., earthwork. 3. The different modes of fencing and enclosing plantations; their relative advantages, durability, cost of construction, and repairs. 4. The setting out and formation of roads for temporary or permanent use. 5. The construction of bridges over streams and gullies; of gates or other entrances. 6. The construction and working of estate saw-mills.

V.—BOOK-KEEPING AND ACCOUNTS.

1. Questions in Practice, Proportion, and Decimal Fractions. 2 Book-keeping—describe books to be kept; and best method of valuing timber. 3. Practical questions in Book-keeping will also be given.

EXAMINATION PAPERS, 1901

PRACTICAL FORESTRY.

1. State briefly the operations necessary for the proper management of plantations. Give the period of the year for each—
   - (1) In connection with and planting in (*a*) damp and exposed situations; (*b*) in dry, sheltered, or moderately exposed situations;
   - (2) In connection with, and thinning of, plantations of various trees and ages;
   - (3) In connection with, and the felling of, marketable and mature timber; and
   - (4) Other operations required to ensure the healthy development of the plantation.

2. What are the mechanical appliances required for the conversion of timber?—
   - (1) Construction of simple saw-mill.
   - (2) Motive power to suit varying circumstances.
   - (3) Mode of transport of timber to and from the saw-mill.

3. Name and describe some of the most important defects found in timber which lessen its value. State the cause of such defects, and the ultimate result.

4. What are the principal effects on forest soil produced by a dense crop of trees standing upon it?

5. How may damage to woods by storms be mitigated?

6. What conditions must the wood-capital of a forest estate fulfil if a sustained annual yield of a certain class of produce is to be obtained from it?

(*Two hours allowed.*)

FOREST BOTANY AND FOREST ZOOLOGY.

Candidates are expected to answer five questions—three from the Section of Forest Botany, and two from the Section of Forest Zoology.

(a) Forest Botany.

1. Write an account of the general vegetative and reproductive characters of the British oak. To what natural order does this tree belong? What other British trees belong to the same order? Distinguish them from the oak.

2. What is the structure of a vegetative bud? Give an account of the horticultural operation of budding, illustrating your answer by reference to an individual case. How does budding differ from grafting? What are the principles that would determine your adoption of one or other practice in a particular instance?

3. Write an account of the phenomenon of transpiration. Show how it is affected by

(a) Temperature of the air;
(b) Temperature of the soil.

4. Describe the construction of the stem of a forest-tree, and show how its several parts are adapted to the work they have to do.

(b) Forest Zoology.

1. Compare the pine beetle (*Hylesinus* or *Hylurgus piniperda*) and the pine weevil (*Hylobius abietis*) under the following heads—

(a) Imago;
(b) Larva;
(c) Character of damage;
(d) Preventive and remedial measures.

2. Give the life-history of the woolly aphis (*Schizoneura lanigera*) or the beech scale (*Coccus fagi*), with the modes of combating the pest.

3. Name three insects that cause galls on trees. Give the life-history of one, and say how you recognise its gall or galls.

(Two hours allowed.)

PHYSICS, CHEMISTRY, AND METEOROLOGY.

1. A cubic foot of water weighs 62·5 lb.; what is the pressure on the plunger of a force-pump of 4 inches area when supporting a column of water 30 feet high?

2. At 10° C. and 700 mm. pressure a mass of air occupies 20 cubic feet; what volume will it occupy if the temperature is raised to 15° C. and the pressure to 800 millimetres?

3. How much carbonic acid can be got by the combustion of 24 lb. of carbon, and how much lime would be needed to absorb it and convert it into carbonate of lime? $C=12$, $O=16$, $Ca=40$.

4. How does starch differ from glucose in composition and chemical and physical properties? How can starch be converted into glucose?

5. Felspar is said to be the source of clay. Explain the process.

6. How do you account for the formation of hoar-frost?

(An hour and a half allowed.)

FOREST ENGINEERING, INCLUDING LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, BRIDGING, ROAD-MAKING, AND SAW-MILLS.

1. Calculate the contents of a rectangular piece of ground, the lengths of the two sides being 834 and 942 feet, and the square width 583 feet, and give the result in acres and decimals of an acre.

2. Show form of level book with twelve sights or levels at different points, giving assumed distances and the levels made up to a given datum.

3. Show sketch section of No. 2, lay down upon it a gradient or line of inclination between the first and last points, and state the rate of inclination.

4. Calculate cubic contents from the following figures: 26 feet 8½ inches by 19 feet 2½ inches by 8 feet 7 inches, giving the result in cubic yards.

5. Give the capacity in gallons of a cylinder 15 feet 10¾ inches long by 2 feet 9¼ inches diameter.

6. What quantity of road metal is required for a road 506 feet long, 24 feet wide, and five inches thick, giving the result in tons, allowing 24 cwts. for each cubic yard?

7. Give sketch section and dimensions of a barn roof covered with slates 24 feet span.

(*Two hours allowed.*)

ARITHMETIC AND BOOK-KEEPING.

1. Find the cost, in decimals of £1, of 696·8 cubic feet of wood at 1s. 1¾d. per cubic foot.

2. Find by Practice the value of 3 tons, 17 cwt. 3 qrs. 21 lb. 12 oz. at £2 per ton.

3. You are engaged as forester on an estate at a salary of £100 per annum, payable half-yearly, and are given the option of a rise of £5 every *half-year*, or of £20 every *year*. Say which you would choose, and give your reasons.

4. If 1000 young trees are bought at £16 per 100, and 500 of them sold at 5 for £1, while the remainder are sold at 6 for £1, what is the gain per cent on the transaction, if 5 per cent commission is charged by the auctioneers on both purchases and sales?

5. What would be the cost of planting a piece of ground, measuring 1 acre, 3 roods, 20 poles, with young trees costing 50s. per 100, when each tree requires 25 square feet of ground?

6. Name the books you would recommend a forester to keep. Draft Daily Labour Roll for week ending 31st December, and show how work done by two workmen at 3s. per day would be recorded.

7. The following is a list of transactions by A. B., forester on Woodland Estate for month ending 30th June 1900. Show these under their respective branches in a statement of Receipts and Expenditure.

The balances brought from previous month were as follows: On hand, £5; in bank, £200.

All sums received are paid into bank, and all payments above £10 are made by cheque.

Exclude the bank transactions from the Statement, and show a copy of the Bank Account as it would appear in the Estate Ledger, bringing out the Bank Balance shown at the close of the Statement.

1900.					
June	1.	Received price of 300 small oaks, at £6 per 100, sold to J. Cowan by private bargain	£18	0	0
"	4.	Price of 1000 Scots pines, sold by public auction at 10s. each	500	0	0
"	8.	Paid wages of day-labourers and piece-workers for week to 7th inst.	60	0	0
"	9.	Paid J. Thomson for young trees	60	0	0
		" carriage on young trees	3	0	0
"	10.	Drawn from bank to meet cash payments	15	0	0
"	11.	Paid for smithy work	5	0	0
		" J. Syme for repairs to lodges	12	0	0
"	13.	Received proceeds of sale of cut timber	40	0	0
"	15.	Paid wages for week to 14th inst.	50	0	0
		" salaries and allowances for month	40	0	0
"	16.	" for carpentry work for half-year	4	0	0
"	22.	" wages for week to 21st inst.	55	0	0
"	23.	" for stationery	2	0	0
"	28.	Received rent of saw-mill for half-year to Whitsunday	50	0	0
		Paid G. Walker for advertising	4	0	0
"	29.	" wages for week to 28th inst.	58	0	0
"	30.	Overdraft interest charged by bank for half-year	5	0	0

(An hour and a half allowed.)

DAIRY DEPARTMENT

EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING

This Examination, instituted in 1897, is conducted by the National Agricultural Examination Board, appointed jointly by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland.

REGULATIONS.

1. The Societies may hold annually in England and in Scotland, under the management of the National Agricultural Examination Board appointed by them, one or more Examinations for the National Diploma in the Science and Practice of Dairying; the Diploma to be distinguished shortly by the letters "N.D.D."

2. The Examinations will be held on dates and at places from time to time appointed and duly announced.

3. A deposit of £1 will be required from each candidate, which deposit will be returned to those who, at the first attempt, succeed in obtaining the Diploma. The Board may, at their discretion, allow an unsuccessful candidate to sit for one subsequent Examination without payment of a further deposit.

4. Forms of Entry for the Examination in England may be obtained from the Secretary of the Royal Agricultural Society of England, 13 Hanover Square, London, W., and must be returned to him duly filled up, with the deposit of £1, on or before 1st September.

5. Forms of Entry for the Examination in Scotland may be obtained from

the Secretary of the Highland and Agricultural Society of Scotland, 3 George IV. Bridge, Edinburgh, and must be returned to him duly filled up, with the deposit of £1, on or before 1st September.

6. A candidate may enter for the Examination either in England or Scotland, but not in both; and a candidate who has once taken part in an Examination in England cannot enter for an Examination in Scotland, or *vice versa.*

7. A candidate will be required to satisfy the Examiners, by means of written papers, practical work, and *vivâ voce*, that he or she has—

(1) A general knowledge of the management of a Dairy Farm, including the rearing and feeding of Dairy Stock, the candidate being required to satisfy the examiners that he or she has had a thorough training and practical experience in all the details of Dairy work as pursued on a farm.

(2) A thorough acquaintance, both practical and scientific, with everything connected with the management of a Dairy, and the manufacture of Butter and Cheese.

(3) Practical skill in Dairying, to be tested by the making of Butter and Cheese.

(4) Capacity for imparting instruction to others.

8. The Board reserve the right to postpone, to abandon, or in any way, or at any time, to modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.

By Order,

ERNEST CLARKE,
Secretary, Royal Agricultural Society of England,
13 Hanover Square, London, W.

JAMES MACDONALD,
Secretary, Highland and Agricultural Society of Scotland,
3 George IV. Bridge, Edinburgh.

SYLLABUS OF SUBJECTS OF EXAMINATION

I.—GENERAL MANAGEMENT OF A DAIRY FARM.

1. *General Management of Pastures and Crops on a Dairy Farm.*

2. *Buildings.*—Situation, Surroundings, Construction, Ventilation, and Drainage of Farm Buildings. Suitability of building materials. Water supply. Construction and arrangements of Dairies: (*a*) for General Purposes; (*b*) for Special Purposes.

3. *Foods and Feeding.*—Summer and Winter Feeding of Dairy Cattle. Root crops. Green fodder. Ensilage. Different kinds of food and their composition. Their effect upon Milk, Butter, and Cheese. Special Foods used in Dairy Feeding. Preparation of food for Dairy Stock. Rearing and feeding of young Stock. Feeding and management of Pigs and Poultry.

4. *Dairy Cattle in Health and Disease.*—Characteristics of different Breeds, and choice of Dairy Cattle. General functions of the organs of the animal body. Breeding. Parturition. Organs which secrete milk. Process of milk secretion. Changes which food undergoes during digestion. Diseases of Dairy Cattle and their remedies.

II.—MANAGEMENT OF A DAIRY.

1. *Milk and Cream.*—Process of Milking. Dairy Utensils and Appliances, hand and power. Cooling of Milk. Separation and ripening of Cream. Different systems of Cream-raising. Utilisation of Skim-milk.

Keeping of Milk. Importance of Cleanliness. Diseases spread by Milk. Conveyance and sale of Milk. Milk records. Keeping of Dairy and Farm Accounts. Creameries. Butter and Cheese Factories. Different systems of Dairying and their comparative returns.

2. *Butter.*—Churns and other Butter-making appliances, hand and power. Souring of Cream. Churning. Washing and working of Butter. Butter-milk. Packing and transmission of Butter. Salting and keeping of Butter. Colouring. Characteristics of good Butter.

3. *Cheese.*—Principles of its manufacture. Making of different kinds of Cheese (from cream, whole-milk, and skim-milk). Acidity of Milk. Use of Rennet and its substitutes. Whey. Appliances for Cheese-making. Ripening and storage of Cheese. Packing and sale of Cheese. Making of Cream and other soft Cheeses.

III.—CHEMISTRY AND BACTERIOLOGY.

[*N.B.*—In this Section there will be expected of the candidate a sound understanding of the scientific principles underlying the practice of Dairying, a knowledge of the composition, nature, properties, and changes undergone by the different substances met with in Dairying, and a general acquaintance with the principles of laboratory methods so far as Dairying is concerned.]

1. *General Principles of Chemistry.*—The nature of elements and compound bodies The different forms of matter—solid, liquid, gaseous. Specific gravity, and instruments for determining it. Temperature, and methods of measuring it. Thermometric scales. The influence of temperature in Dairy operations. Physical and chemical changes involved in the following: solution, precipitation, filtration, distillation, oxidation, and reduction. Acids, Bases, Salts—their distinctive properties. Acidity and Alkalinity—their influence and quantitative estimation.

The Atmosphere—its constituents and impurities; its influence on Dairy operations. Atmospheric pressure.

Water - constituents of pure and natural waters. The impurities of water and whence derived. The importance of a pure water-supply in Dairying.

General knowledge of the elementary chemistry of the following substances and their compounds so far as met with in Dairying: Potash, Soda, Ammonia, Lime, Phosphoric Acid, Alcohol, Acetic Acid, Carbonic Acid, Butyric Acid, Lactic Acid, Albumen, Casein, Fats, Milk-sugar, Glycerine, Pepsin.

Saponification of Fats.

2. *Milk and its Products.*—The nature, composition, properties, and chemical constituents of milk. Microscopical appearances presented by milk. The circumstances that affect the quality and quantity of milk produced by the cow. The influence of feeding. The changes which occur in the keeping of milk, and how produced. The natural and artificial souring of milk. Rennet, its nature and use. Physical and chemical changes involved in the making and keeping of Butter, and in the manufacture and ripening of Cheese. Separated Milk, Condensed Milk, Fermented Milk. The use of Preservatives. Methods of Milk-testing—Mechanical methods, their theory and practice. A general knowledge of the methods employed in the chemical analysis of Milk and Butter. Adulteration of Milk, Cream, Butter, and Cheese—the ways in which adulteration is practised, the changes in composition thereby produced, and a general knowledge of the methods employed in detecting the same.

3. *The Chemistry of Feeding.*—The principal constituents of Food materials, and the functions they severally fulfil. The influence of Food constituents on milk production. Assimilation and Digestion.

Animal Heat and Respiration.- Milk as a Food. The relation of Food to Manure.

4. *Bacteriology.*—Moulds. Yeasts. Bacteria. The principal kinds of Bacteria met with in Dairying—their forms, methods of reproduction, and conditions of life. The influence of physical agencies upon Bacterial life. Air and Water as carriers of Bacteria. The changes produced by Bacteria in milk and its products. Useful forms and their functions. Harmful forms and their effects—Coagulation, Discoloration, Taints, &c. Pathogenic organisms. The classification of organisms—organised ferments and enzymes. Methods of preparation of pure cultures and their practical use. Nutritive media. Pasteurisation and Sterilisation — the practical application of these to Dairy matters. Fermentation and Putrefaction. Disinfectants and Preservatives.

IV.—PRACTICAL SKILL IN DAIRY WORK.

Candidates must be prepared—(1) to produce at or before the Examination a satisfactory certificate of proficiency in the Milking of Cows, signed by a practical Dairy Farmer; (2) to churn and make into Butter a measured quantity of Cream; and (3) to make one Cheese of each of the following varieties: (i) Hard-pressed, of not less than 30 lb.; (ii) Veined or blue-moulded, of not less than 10 lb.; and (iii) also to make one or other of the following Soft Cheeses: Camembert, Coulommier, or Pont l'Evêque.

V.—CAPACITY FOR IMPARTING INSTRUCTION TO OTHERS.

Candidates must also show practically that they are familiar with the management of a Dairy, and are capable of imparting instruction to others.

EXAMINATIONS IN 1902.

ENGLAND—Monday, September 22, to Thursday, September 25, at the Reading College and British Dairy Institute, Reading; last date for receiving applications, 1st September.

SCOTLAND—Monday, September 29, to Thursday, October 2, at Kilmarnock; last date for receiving applications, 1st September.

The following obtained the Diploma in Scotland in 1901 :—

Macara, Beatrice Mary, Ardmore, St Annes-on-Sea.
Thompson, Catherine Ella Beatrice, Mill of Wester Coull, Aboyne.

The following obtained the Diploma in England in 1901 :—

Gardner, Miss M. P., Ellerslie, Gosforth, Cumberland.
Hardy, Edward G., c/o E. S. Smith, Old Hall Farm, Great Steeping, Spilsby, Lincolnshire.
Hoare, Elizabeth C., British Dairy Institute, Reading.
Inglis, Annie, Midland Dairy Institute, Kingston, Derby.
La Mothe, Bertha M., British Dairy Institute, Reading.
Lesser, Samuel, 14 Westbourne Terrace, London, W.

Past Examination Papers.

Copies of the Papers set at the Examination in 1901 may be had on application. Price 6d. per set.

CHEMICAL DEPARTMENT

Chemist to the Society—Dr A. P. Aitken, Chemical Laboratory, 8 Clyde Street, Edinburgh.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding-stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

MEMBERS' PRIVILEGES IN RESPECT OF ANALYSES.

The fees of the Chemist for analyses made for members of the Society shall, until further notice, be as follows:—

The estimation of *one* ingredient in a manure or feeding-stuff, . 5s.
The estimation of *two* or *more* ingredients in do. . 10s.

These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

Valuations of manures, according to the Society's scale of units, will be supplied if requested.

MISCELLANEOUS.

	£	s.	d.
Analysis of water [1] to determine purity, hardness, and fitness for domestic use (not more than one analysis per year for any one member),	£1	0	0
Analysis of agricultural products—hay, grain, ensilage, roots, &c.,	1	0	0
Milk, full analysis,	0	10	0
" solids and fat,	0	5	0
" fat only,	0	2	6
Butter, full analysis,	0	10	0
" partial analysis (solids and fat),	0	5	0
Cheese,	0	10	0
Limestone, giving the percentage of lime,	0	5	0
Limestone, complete analysis,	1	0	0
Analysis of soil, to determine fertility and recommendation of manurial treatment,	1	10	0
Complete analysis of soil,	2	10	0
Search for poisons in food or viscera,	2	0	0

Samples should be sent (carriage paid) to Dr A. P. Aitken, 8 Clyde Street, Edinburgh.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

MANURES.

Any method of sampling mutually agreed upon between buyer and seller may be adopted, but the following method is recommended as a very complete and satisfactory one: Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which

[1] Cases containing bottles for water samples and instructions for sampling are sent from the laboratory on application.

it may contain being broken down with the hand. Of this mixture two samples of about half a pound each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the chemist for analysis.

FEEDING-STUFFS.

Samples of feeding compounds may be taken in a similar manner.

Samples of cake should be taken by selecting three cakes, breaking each across the middle, and from the broken part breaking off a segment across the entire breadth of the cake. The three segments thus obtained should be wrapped up and sealed by the samplers, and sent for analysis as in the case of manures, and three duplicate segments similarly sealed and labelled should be retained by the purchaser.

SOILS.

Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench vertical scrapings of the soil down to the top of the subsoil. Catch these on a clean board, and collect in this manner two pounds of soil taken from the whole surface of the section. Similar scrapings of subsoil immediately below should be taken and preserved separately. Five or six similarly drawn samples at least should be taken from different parts of the field, and kept separate while being sent to the chemist, that he may examine them individually before mixing in the laboratory.

VEGETABLE PRODUCTS.

Turnips, &c., 20 to 40 bulbs carefully selected as of fair average growth.

Hay, straw, ensilage, &c., should be sampled from a thin section cut across the whole stack or silo, and carefully mixed about ; above 2 lb. weight is required for analysis.

Grain should be sampled like manures.

DAIRY PRODUCE.

Milk.—Samples of milk from individual cows should be taken direct from the milk-pail after complete milking. Average samples from a number of cows should be taken immediately after milking. Specify whether the sample is morning or evening milk, or a mixture of these in equal parts. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed.

For most purposes a pint bottle of milk is a large enough sample.

Butter and Cheese.—About quarter-pound samples are required.

WATERS.

When the water is from a well, it should be pumped for some minutes before taking the sample.

If the well has been standing unused for a long time, it should be pumped for some hours, so that the water may be renewed as far as possible.

If the well has been newly dug or cleaned out, it should be pumped as dry as possible, daily, for a week before taking the sample.

Water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck upwards, some inches below the surface. *Water from the surface should not be allowed to enter the bottle.*

Spring or stream water should not be sampled in very wet weather, but

when the water is in ordinary condition. Such waters should be sampled by immersing the bottle, if possible; but if not deep enough for that purpose, a perfectly clean cup should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing it.

Interference with or disturbance of wells or springs, or the ground in their immediate vicinity, must be carefully avoided during sampling, and for at least twenty-four hours before it.

After a sample has been taken, it should be sent to the laboratory as speedily as possible.

A description of the source and circumstances of the water should accompany the sample, as the interpretation of the analytical results depends to some extent on a knowledge of such particulars.

N.B.—Stone jars and old wine bottles are unsuitable for conveying samples. Winchester quarts chemically cleaned should be obtained from the laboratory here.

LOCAL ANALYTICAL ASSOCIATIONS.

With the view of encouraging, as well as regulating the conduct of, Local Analytical Associations, the Society, from 1881 to 1893, contributed from its funds towards their expenses a sum not exceeding £250 annually. In view of the passing of the Fertilisers and Feeding Stuffs Act, 1893, it was decided, at a meeting of the Directors on the 6th of December 1893, to discontinue that grant after the 1st of March 1894.

COMPOSITION AND CHARACTERISTICS OF MANURES AND FEEDING-STUFFS.

(*See 'Transactions,' Fifth Series, vol. xi.* 1899.)

FORMS OF GUARANTEE

Guarantee of Manure.

I guarantee that the manure called......................and sold by me to ....contains a minimum of—

Soluble phosphoric acid	=Phosphate of lime dissolved	...........per cent.
Insoluble phosphoric acid	=Phosphate of lime undissolved	..........per cent.
Potash salts . .	=Potash (K_2O)	.........per cent.
Total nitrogen . .	=Ammonia	........per cent.

Signature of seller........................

Date..................19...

Guarantee of Feeding-Stuff.

I guarantee that the feeding-stuff called...............and sold by me to ....contains a minimum of—

.... per cent albuminoids.
.... per cent oil.
.... per cent carbohydrates.

Signature of seller........................

Date..................19...

UNITS TO BE USED IN DETERMINING THE COMMERCIAL VALUE OF MANURES.[1]

Terms—CASH, including Bags gross weight—not including Carriage.

N.B.—These units are based on the RETAIL PRICES at the following seaports: Berwick, Leith, Bo'ness, Dundee, and Glasgow. When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price at which TWO TONS may be bought in fine sowable condition. Larger purchases may be made on more favourable terms, but for smaller purchases an extra charge of 1s. 6d. per ton is made.

For Season 1902.

CASH PRICES as Fixed on 5th February.

Items to be Valued.	Peruvian (Riddled). Ammoniacal.	Peruvian (Riddled). Phosphatic.	Bone-Meal.	Steamed Bone Flour.	Dissolved or Vitriolated Bones.	Superphosphates. 28% Sol. Phos. or under.	Superphosphates. Over 28% Sol. Phos.
	P unit	P unit	P unit	P unit	P unit	P unit	P unit.
Phosphates dissolved	1/6	1/4	..	.	2/6	1/11	1/10
" undissolved			1/2	1/2	1/2	..	..
Nitrogen	17/7	15/-	11/-	11/-	12/-	.	.
or Ammonia	14/6	12/6	9/-	9/-	10/-	.	
Prices per ton, Feb. 5, 1902— From	150/-	105/-	90/-	85/-	95/-	45/-	55/-
To	200/-	150/-	100/-	95/-	105/-	55/-	65/-

MANURES

		Guarantee.	Price per Ton.	Unit.
		Per cent.	£ s. d.	
Sulphate of ammonia[2]	ex ship	24 Ammonia	11 15 0	Am. = 9/9
Nitrate of soda, 95 per cent[2]	"	19 "	10 0 0	" = 10/6
Muriate of potash, 80 per cent	"	50 Potash	8 15 0	Pot. = 3/6
Sulphate of potash, 80 per cent, or over	"	..	..	" = 3/9
Kainit	"	12 Potash	2 0 0	" = 3/4
Potash salts		20 "	4 12 6	" = 3/6
Thomas-slag phosphate at place of production		30 Phosphate	1 15 0	Phos. = 1/2
" "		38 "	2 0 0	" = 1/-

1 Instructions regarding units and the valuation of manures are given on p. 33.
2 These are the February prices, but they are subject to variation from month to month or oftener.

Feeding-Stuffs.	Average Analyses.			Price per Ton in bags.
	Album.	Oil.	Carbo-hydrates.	£ s. d.
Linseed-cake	28	9	35	8 10 0
" Canadian or American	28	8	35	7 12 6
Decorticated cotton-cake	45	10	20	7 5 0
Undecorticated do. (Home)	24	7	25	5 0 0
Bean-meal [1]	25	2	50	7 15 0
Locust-bean meal	6	2	70	5 12 6
Dried Distillery grains	20	8	50	5 5 0
Barley-bran	15	5	50	5 10 0
Indian corn [1]	10	5	55	5 15 0
Paisley meal	15	9	60	6 0 0
Linseed (whole)	20	35	14	16 10 0
Linseed-oil				30 0 0
Treacle				5 15 0

[1] These are the February prices, but they are subject to variation from month to month or oftener.

CLASSIFICATION OF MANURES.

Bone-meal	Genuine bone-meal contains from 48 per cent to 55 per cent phosphates, and from 4 per cent to 5 per cent ammonia. If phosphates are low, ammonia will be high, and conversely.
Steamed bone-flour	Ground to flour and containing about 60 to 65 per cent phosphates, and about 1½ to 2½ per cent ammonia.
Dissolved bones	Must be pure—*i.e.*, containing nothing but natural bones and sulphuric acid.
Mixtures and compound manures	To be valued according to the unit values (as given above) of the ingredients of which they are guaranteed *and also found* to be composed, with an addition of 10s. per ton for mixing.
Thomas-slag	Fineness of grinding is of paramount importance. The coarsest kind used should be so finely ground that 80 per cent passes through a sieve of 10,000 holes per sq. inch.

INSTRUCTIONS FOR VALUING MANURES.

The unit used for the valuation of manures is the hundredth part of a ton, and as the analyses of manures are expressed in parts per hundred, the percentage of any ingredient of a manure when multiplied by the price of the unit of that ingredient represents the value of the quantity of it contained in a ton.

As an example take muriate of potash—a good sample (see p. 31) will be guaranteed to contain 80 per cent *pure* muriate of potash; the other 20 per cent consisting of unimportant impurities such as common salt. But all potash manures are valued according to the amount of POTASH they yield, and 80 per cent of pure muriate of potash yields 50 per cent potash (K_2O)—*i.e.*, 50 units per ton, and as a ton of muriate of potash costs £8, 15s. the price of the unit is the fiftieth part of that—viz., 3s. 6d. If on analysis a sample of muriate of potash guaranteed to contain 50 per cent of potash is found to contain only 49 per cent, the price per ton will be 3s. 6d. less—viz., £8, 11s. 6d.

Similarly with all other manures the price per unit is derived from the price per ton of a sample of good material up to its guarantee, and therefore the proper price per ton of a manure is found by multiplying the price of the unit of the valuable ingredient by the percentage as found by analysis. If a manure contains more than one valuable ingredient the unit value of each ingredient is multiplied by its percentage, and the values so found when added together give approximately the price per ton of the manure.

Nitrate of soda contains no ammonia but it contains nitrogen, and 14 units of nitrogen are equivalent to 17 units of ammonia, and it is the custom in Scotland to value all nitrogenous manures not according to the nitrogen they contain but according to its equivalent of ammonia.

The commercial values of manures are determined by means of the UNITS in the following manner:—

Take the analysis of the manure, and look for the following substances:—

Phosphates dissolved (or soluble phosphate)	No other items but these are to be valued.
„ undissolved (or insoluble „)	
Nitrogen = Ammonia	
Potash	

Should the analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.

Suppose the manure is bone-meal:—

An ordinary bone-meal will contain about 50 per cent phosphate and nearly 4 per cent ammonia. The units for bone-meal are 1s. 2d. for phosphate and 9s. for ammonia. Therefore the value is—

	£	s.	d.
Insol. phosphate, 50 times 1s. 2d., equal to	£2	18	4
Nitrogen = Ammonia, 4½ times 9s., equal to	2	0	6
Say	£4	19	0 per ton.

Suppose the manure is dissolved or vitriolated bones:—

It must be guaranteed "pure."

The units in the Schedule are 2s. 6d. for soluble phosphate, 1s. 2d. for insoluble phosphate, and 10s. for ammonia.

The analysis will be about 16 per cent soluble phosphate, 20 per cent insoluble phosphate, and 3 per cent ammonia. In that case the value would be—

Sol. phosphate,	16 times 2s. 6d., equal to	£2	0	0	
Insol. ,,	20 ,, 1s. 2d., ,,	1	3	4	
Nitrogen = Ammonia, 3 ,, 10s., ,,		1	10	0	
	Say	£4	13	4	per ton.

Suppose the manure is a superphosphate,—say an ordinary superphosphate, with 28 per cent soluble phosphate and 3 per cent insoluble phosphate. It is valued thus :—

Sol. phosphate, 28 times 1s. 11d., equal to, say, £2, 13s. 8d. per ton.
Insoluble phosphate is not valued in a superphosphate.

Note.—The units have reference solely to the COMMERCIAL VALUES of Manures, and not to their AGRICULTURAL VALUES.

Thus, in stating soluble phosphate in dissolved bones at 2s. 6d. per unit, and that in superphosphate at 1s. 10d., it is meant that these are the prices per unit at which soluble phosphate can be bought in these two manures; but it does not mean that the soluble phosphate in the one is 8d. per unit better as a manure than that in the other. It is probably no better.

BOTANICAL DEPARTMENT

Consulting Botanist to the Society—A. N. M'ALPINE,
6 Blythswood Square, Glasgow.

The Society have fixed the following rates of charge for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

Scale of Charges.

1. A report on the purity, amount, and nature of foreign materials, 2s.
2. On the germinating power of a sample of seed, 2s.
3. Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention, 5s.
4. Report on any disease affecting farm crops, 5s.
5. Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value, 1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

Instructions for Selecting and Sending Samples.

In sending seed or corn for examination, the utmost care must be taken to secure a fair and honest sample. In the case of grass seeds, the sample would be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser. If anything supposed to be

injurious or useless exists in the corn or seed selected, samples should also be sent.

When possible, at least one ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which the seed has been bought (but preferably, a copy of the invoice) should accompany the sample.

Grass seeds should be sent at least four weeks, and clover seeds three weeks, before they are to be used.

In collecting specimens of plants, the whole plant should be taken up and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

It is strongly recommended that members purchasing seeds should insist—

(1) Upon having from the seller a guarantee stating the purity and germination of the seed supplied.

(2) That the bulk be same as sample.

(3) That it contain not more than 5 per cent other than the species ordered.

If the purity and germination of the seed is not known, it is impossible to tell either its money value or the proper amount to be sown.

It is also strongly recommended that the purchase of prepared mixtures should be avoided, and the different seeds to be used should be purchased separately.

Parcels or letters containing seeds or plants for examination (carriage or postage paid) must be addressed to Professor M'Alpine, Botanical Laboratory, 60 John Street, Glasgow.

INSECT PESTS.

Arrangements have been made with Mr R. Stewart MacDougall, M.A., D.Sc., Edinburgh, to advise members of the Society regarding insects or allied animals which, in any stage of their development, infest—

(*a*) Farm crops.
(*b*) Stored grain.
(*c*) Garden and greenhouse plants.
(*d*) Fruit and fruit trees.
(*e*) Forest trees and stored timber.
(*f*) Live stock (including poultry).

Members consulting Dr MacDougall will please forward with their queries examples of the injured plants, or the injured parts of plants, &c., as well as specimens of the insects or other animals believed to be the cause of the injury.

Specimens should be sent in tin or wooden boxes, or in quills, to prevent injury in transmission.

Address letters and parcels (carriage or postage paid) to Dr R. Stewart MacDougall, 13 Archibald Place, Edinburgh.

The Directors have fixed the fee payable by members to Dr MacDougall at 1s. for each case upon which he is consulted; this fee must be sent to him along with the application for information.

PREMIUMS

GENERAL REGULATIONS FOR COMPETITORS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to the Premium offered, or a portion of it, will be opened without the author's consent.

4. Reports for which a Premium, or a portion of a Premium, has been awarded, become the property of the Society, and cannot be published in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. The Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded or accepted. Weights and measurements must be indicated by the imperial standards.

7. The Directors, before or after awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all matters relating to Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject not included in the Premium List; and if the topic and the treatment of it are both approved, the writer may be remunerated and his paper published.

CLASS I.

REPORTS.

Section 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

FOR APPROVED REPORTS.

1. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purposes chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

2. Approved Reports on other suitable subjects. To be lodged by 1st November in any year.

Section 2.—ESTATE IMPROVEMENTS.

FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty acres of Waste Land—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

3. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land

—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Reports in competition for Nos. 3, 4, and 5 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

5. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

6. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 5 and 6 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

Section 3.—HIGHLAND INDUSTRIES and FISHERIES.

FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland—Five Sovereigns. To be lodged by 1st November 1902.

Section 4.—MACHINERY.

FOR APPROVED REPORTS.

To be lodged by 1st November in any year.

Section 5.—FORESTRY DEPARTMENT.

FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat-bog—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November 1902.

The premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

CLASS II.

DISTRICT COMPETITIONS.

Regulations 1902.

As to payment of Grants, see Regulation 10, *Section* 1.

Grants in aid of District Competitions *for* 1903 *must be applied for before* 1*st November* 1902, *on Forms to be obtained from the Secretary.*

When a Grant has expired, the District cannot apply again for aid for two years.

Section I.—GRANTS TO DISTRICT SOCIETIES FOR HORSES, CATTLE, SHEEP, AND PIGS.

1. Class of Stock—Limit of Grants, £340.—The Highland and Agricultural Society will make Grants to District Societies to deal with, as in the opinion of the District Societies the need of each district may require, for such classes of *breeding* Stock of Horses, Cattle, Sheep, and Pigs as are embraced in the General Show Prize List of the Highland and Agricultural Society. The total sum to be expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £340 in any one year.

2. Grant to District, £12.—The portion of the Grant to any one District Society shall not exceed the sum of £12 in any one year.

3. Continuance of Grant Three Years—Advertising.—The Grant shall continue for three alternate years, provided always that the District

Society shall, in the two intermediate years, continue the competition by offering Premiums equal in amount to not less than one-half the sum given by the Highland and Agricultural Society, and for the same class of Stock as that selected in each previous year to compete for the Highland and Agricultural Society's Prizes. The Prizes when given by the Highland and Agricultural Society must be announced as the Society's gift. If no competition takes place for two years the Grant expires.

4. When it is agreed to hold the General Show of the Society in any district, no provincial show shall be held in that district in the months of June, July, or August.

5. MEDALS.—In the two alternate years the Highland and Agricultural Society will place three Silver Medals at the disposal of the District Societies, for the same classes of Stock as those for which the Money Premiums are offered, provided that not less than three lots are exhibited in the same class.

6. RULES OF COMPETITION.—The Rules of Competition for the Premiums, the Funds for which are derived from Grants of the Highland and Agricultural Society, shall be such as are generally enforced by the Society receiving the Grant for Premiums offered by itself.

7. AREA AND PARISHES—FIVE PARISHES.—When making application for Grants from the Highland and Agricultural Society, the District Society must delineate the area and the number of parishes comprised in the district, and, *except in special cases*, no District Society shall be entitled to a Grant whose show is not open to at least *five* Parishes.

8. NOMINATION OF MEMBERS. — The Directors may nominate one or more members of the Highland and Agricultural Society resident in the district, whose duty it shall be to see that the conditions imposed by the Board are complied with.

9. REPORTS.—Blank Reports will be furnished to the Secretaries of the different District Societies. These Reports must in all details be completed and lodged with the Secretary of the Highland and Agricultural Society on or before the 1st of November next following the competition, both in the years when the Grant is given and in the two intermediate years, for the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All such Reports must be signed and certified by the Members of the Highland and Agricultural Society nominated under Rule 8.

10. GRANTS—WHEN PAID.—The Grants made to District Societies will be paid as soon as practicable after the Reports of the awards of the prizes have been received and found to be in order and passed by the Board of Directors, the Money Grants being paid to the Secretaries of the Local Societies and the Medals sent direct to the winners. The Secretary of the District Society must not on any condition whatever pay any premium offered by the Highland and Agricultural Society until he has been informed that the awards are in order and has received the grant from the Highland and Agricultural Society.

11. RENEWAL OF APPLICATION.—No application for renewal of a Grant to a District Society will be entertained until the expiration of *two years* from the termination of the last Grant.

12. DISPOSAL OF APPLICATIONS.—In disposing of applications for District Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those District Societies which have been longest off the list.

13. DAIRY PRODUCE.—Upon application being made by District Societies, a limited number of Medals will be placed at the disposal of District Societies for Dairy Produce.

DISTRICTS.

1. Kirriemuir.—*Convener*, T. M. Nicoll, Littleton, Kirriemuir; *Secretary*, Stewart Lindsay, Crawford House, Kirriemuir. Granted 1897. (In abeyance in 1901. No Show held.)
2. Kintyre.—*Convener*, John Ralston, Merchant, Campbeltown; *Secretary*, G. Erskine Inglis, Campbeltown. Granted 1898.
3. St Mary's Isle Estates and District.—*Convener*, , Kirkcudbright; *Secretary*, John Gibson, Solicitor, Kirkcudbright. Granted 1898.
4. Carnwath.—*Convener*, R. J. Logan of New Mains, Carnwath; *Secretary*, John Robertson, Banker, Carnwath. Granted 1898.
5. Stranraer and Rhins of Galloway.—*Convener and Secretary*, John Bennoch, Solicitor, Stranraer. Granted 1898.
6. Sutherland.—*Convener*, Donald M'Lean, Sutherland Estate Offices, Golspie; *Secretary*, J. Mackintosh, Proncy, Dornoch. Granted 1897. (In abeyance in 1901 on account of the Inverness Show.)
7. Stirling.—*Convener*, Duncan M'Laren, Cornton, Bridge of Allan; *Secretary*, Andrew C. Buchanan, 26 Port Street, Stirling. Granted 1899. (In abeyance in 1900 on account of the Stirling Show.)
8. Dunoon.—*Convener*, John Mercer, Ardnadam, Sandbank; *Secretary*, John Dobie, Clydesdale Bank, Dunoon. Granted 1900.
9. Girvan.—*Convener*, Robert Inglis, Lovestone, Girvan; *Secretary*, Andrew Dunlop, Royal Bank, Girvan. Granted 1900.
10. Moffat and Upper Annandale.—*Convener*, William Mackie, Wamphray Gate, Beattock; *Secretary*, John Young, High Street, Moffat. Granted 1900.
11. Glenkens.—*Convener*, Colonel J. M. Kennedy of Knocknalling, Dalry, Galloway; *Secretary*, James M'Gill, New Galloway. Granted 1900.
12. East Kilbride.—*Convener*, ; *Secretary*, William Strang, 141 West Regent Street, Glasgow. Granted 1900.
13. Atholl and Weem.—*Convener*, D. Robertson, Mains of Fordie, Dunkeld; *Secretary*, Hugh Mitchell, Pitlochry. Granted 1900.
14. Lower Ward of Renfrewshire.—*Convener*, H. R. B. Peile, Mansion House, Greenock; *Secretary*, Robert Steuart Walker, 11 William Street, Greenock. Granted 1900.
15. United East Lothian.—*Convener*, William Gillespie, Athelstaneford Mains, Drem; *Secretary*, John Stirling, Solicitor, Haddington. Granted 1902.
16. Lochaber.—*Convener*, R. E. Jones, Fassifern, Fort William; *Secretaries*, Duncan MacNiven, jun., Fort William, and Douglas Coles, Drimnatorran, Strontian. Granted 1902.
17. Castle Douglas.—*Convener*, John M'Kie of Bargally, Ernespie, Castle Douglas; *Secretary*, Malcolm M'L. Harper, British Linen Co. Bank, Castle Douglas. Granted 1902.
18. Strathendrick.—*Convener and Secretary*, W. Watson Murray, Catter House, Drymen. Granted 1902.
19. Breadalbane.—*Convener*, Thomas Watters, Glenample, Lochearnhead; *Secretary*, Peter Buchanan, Solicitor, Callander. Granted 1898. (In abeyance in 1900 on account of the Stirling Show.)
20. West of Scotland Union.—*Convener and Secretary*, John Watson, National Bank, Crosshill, Glasgow. Granted 1899.
21. Lammermoor Pastoral.—*Convener and Secretary*, Thomas Stephenson, Chapel, Duns. Granted 1899.

22. Islay, Jura, and Colonsay.—*Convener*, John Laughton, Ellabus, Islay; *Secretary*, Robert Cullen, Solicitor, Bridgend, Islay. Granted 1901.
23. Arran.—*Convener*, Patrick Murray, Strabane, Brodick; *Secretary*, William Tod, Glenree, Lamlash. Granted 1901.
24. Dumfries.—*Convener*, M. S. M'Kerrow, Boreland of Southwick, Dumfries; *Secretary*, John Blacklock, Solicitor, Dumfries. Granted 1901.
25. Doune.—*Convener*, ; *Secretary*, William Gray, Inspector of Poor, Doune. Granted 1901.
26. Wester Ross.—*Convener*, P. B. Macintyre, Mains of Findon, Conon Bridge; *Secretary*, Ben. Aird, Banker, Dingwall. Granted 1898. (In abeyance in 1901 on account of the Inverness Show.)
27. Strathbogie.—*Convener*, Hugh Wilson, Milton of Noth, Rhynie; *Secretary*, Francis E. Watt, Town and County Bank, Limited, Huntly. Granted 1901. (In abeyance in 1902 on account of the Aberdeen Show.)
28. Inverurie.—*Convener*, John Maitland, Balhalgardy, Inverurie; *Secretary*, John Low, Union Bank, Inverurie. Granted 1898. (In abeyance in 1902 on account of the Aberdeen Show.)
29. Formartine.—*Convener*, David Walker, Coullie, Udny, Aberdeen; *Secretary*, Thos. H. Gibson, Cultercullen, Aberdeen. Granted 1900. (In abeyance in 1902 on account of the Aberdeen Show.)

In 1902.

Nos. 1, 2, 3, 4, 5, and 6 are in competition for the last year.

Nos. 7, 8, 9, 10, 11, 12, 13, and 14 are in competition for the second year.

Nos. 15, 16, 17, and 18 are in competition for the first year.

Nos. 19, 20, 21, 22, 23, 24, 25, and 26 compete for local Premiums.

Nos. 27, 28, and 29 are in abeyance on account of the Aberdeen Show.

Section 2.—GRANTS TO HORSE ASSOCIATIONS, &c., FOR STALLIONS FOR AGRICULTURAL PURPOSES.

1. Horses—Limit of Grant, £210.—The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £210 in any one year.

2. Grant to each, £15.—The portion of the Grant to any one Horse Association, &c., shall not exceed the sum of £15 in any one year.

3. Continuance of Grant Three Years—Intermediate Year.—The Grant shall continue for three alternate years, provided always that the Horse Association or Society shall, in the two intermediate years, offer at least a sum equal in amount to that granted by the Highland and Agricultural Society for the hire of a Horse in connection with the Association or Society to whom the Grant is made.

4. Nomination of Members.—The Directors of the Highland and Agricultural Society shall nominate one or more members of the Highland and Agricultural Society, resident in the Districts in which the Society benefited is located, whose duty it shall be to see that the conditions imposed by the Board are complied with.

5. Reports—Penalty for not engaging Horse.—No Grant by the Highland and Agricultural Society to Horse Associations, &c., will be paid

unless a report, signed and certified by the members appointed under Rule 4, be furnished to the Highland and Agricultural Society not later than the 1st of November in each year in which the Grant is made, and also in the alternate years, stating that a Horse has been engaged by the Horse Association or other Society to whom the Grant is made ; and in the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

6. Rules 10 (Time of Payment), 11 (Renewal of Grant), and 12 (Disposal of Applications) applicable to Section 1, shall be applicable to Section 2.

DISTRICTS.

1. Dumbartonshire Horse-Breeding Society.—*Convener*, Charles W. Ralston, Garscube, Maryhill ; *Secretary*, William Reid, 140 St Vincent Street, Glasgow. Granted 1898.
2. Selkirk and Galashiels.—*Convener*, John Riddell, Rink, Galashiels ; *Secretary*, David C. Finlay, Elm Cottage, Galashiels. Granted 1898.
3. Nairnshire.—*Convener*, George Fiddes, Drumduan, Nairn ; *Secretary*, J. A. Robertson, Royal Stables, Nairn. Granted 1900.
4. Newton - Stewart Horse - Breeding Society.—*Convener*, William Baird, Kirvennie, Wigtown ; *Secretary*, John M'Conchie, Carsewilloch, Creetown. Granted 1900.
5. Deeside Horse-Breeding Association.—*Convener*, Lieut.-Col. F. N. Innes of Learney, Torphins ; *Secretary*, John Cooper, Ley, Banchory. Granted 1902.
6. Vale of Alford Horse-Breeding Society.—*Convener*, William A. Mitchell, Auchnagathle, Whitehouse, Aberdeen ; *Secretary*, John Reid, Balquharn, Alford, N.B. Granted 1902.
7. Clackmannanshire Union.—*Convener*, J. Ernest Kerr, Harviestoun Castle, Dollar ; *Secretaries*, Norval & Roxburgh, 28 Mar Street, Alloa. Granted 1902.
8. Lockerbie Entire Horse Society.—*Convener*, Allan Murray, Castlemilk Mill, Lockerbie ; *Secretary*, James R. Byers, Solicitor, Lockerbie. Granted 1902.
9. East of Fife Entire Horse Society.—*Convener*, J. Brewster, West Newhall, Crail ; *Secretary*, William Rutherford, Thirdpart, Crail. Granted 1902.
10. Windygates. — *Convener*, Sir John Gilmour of Montrave, Bart., Leven ; *Secretary*, William Shepherd, Royal Bank, Leven. Granted 1902.
11. Inverness-shire.—*Convener*, Neil D. Mackintosh of Raigmore, Inverness ; *Secretary*, D. Gray, 36 Union Street, Inverness. Granted 1902.
12. Perth and Coupar-Angus Horse Improvement Society.— *Convener*, W. S. Ferguson, Pictstonhill, Perth ; *Secretary*, James Stewart, Friarton, Perth. Granted 1902.
13. Kilfinan.—*Convener*, Duncan Thomson, Inveryne, Tighnabruaich ; *Secretary*, Neil Nicolson, Auchgoyle, Tighnabruaich. Granted 1899.
14. Fyvie.—*Convener*, John Ferguson, Westertown, Rothienorman ; *Secretary*, John Hay, Mill of Crichie, Fyvie. Granted 1899.
15. Kinross-shire.—*Convener*, James Simpson of Mawcarse, Milnathort ; *Secretary*, John Hay, High Street, Kinross. Granted 1899.
16. Glenkens, Balmaghie, and Parton.—*Convener*, John M'Cormick, Lochenkit, Corsock, Dalbeattie ; *Secretary*, Robt. T. Scott, Drumhumphrey, Corsock, Dalbeattie. Granted 1899.

17. MACHARS.—*Convener*, William Smith, Garrarie, Portwilliam; *Secretary*, Charles M. Routledge, British Linen Co. Bank, Portwilliam. Granted 1899.
18. POLTALLOCH. — *Convener*, R. A. Meikle, Ri-cruin, Lochgilphead; *Secretary*, Arch. Taylor, Ri-cruin, Lochgilphead. Granted 1901.
19. SPEYSIDE CLYDESDALE HORSE-BREEDING SOCIETY.—*Convener*, Colonel George Smith Grant, Auchorachan, Glenlivet; *Secretary*, A. R. Stuart, Inverfiddich, Craigellachie. Granted 1901.
20. ATHOLL AND BREADALBANE. — *Convener and Secretary*, James J. Gillespie, St Colmes, Ballinluig. Granted 1901.

In 1902.

Nos. 1 and 2 are in competition for the last year.
Nos. 3 and 4 are in competition for the second year.
Nos. 5, 6, 7, 8, 9, 10, 11, and 12 are in competition for the first year.
Nos. 13, 14, 15, 16, 17, 18, 19, and 20 compete for local premiums.

DAIRY PRODUCE.

Upon application being made by District Societies, a limited number of Silver Medals will be placed at the disposal of District Societies for Dairy Produce.

The Medals are granted for two years, and lapse if not awarded in those years.

GALLOWAY DAIRY PRODUCE SHOW.—*Convener*, Sir Mark J. M'Taggart Stewart, Bart., M.P., Ardwell, Wigtownshire; *Secretary*, Patrick Gifford, Solicitor, Castle Douglas. 2 Medals. 1901.

SPECIAL GRANTS.

£40 to the Highland Home Industries Association.—*Joint-Secretaries*, Miss Muriel K. Mackenzie, Conon House, Conon Bridge, Ross-shire, and Miss Jessie D. C. Ross, Riverfield, Inverness. Granted 1895. (Did not hold a Competition in 1899 or 1900.)

£20 to the Ayrshire Agricultural Association, to be competed for at the Dairy Produce Show at Kilmarnock.—*Convener*, The Hon. G. R. Vernon, Auchans House, Kilmarnock; *Secretary*, John Howie, 58 Alloway Street, Ayr. Granted 1872.

£5 to Shetland Agricultural Society.—*Convener*, J. M. Goudie, Lerwick; *Secretary*, J. Wilson, Commercial Bank, Lerwick. Granted 1893.

£3 to Orkney.—*Convener and Secretary*, James Johnston, Orphir House, Orphir, Orkney. Granted 1883.

£3 to East Mainland, Orkney.—*Convener*, Alfred Reid, Braebuster, Kirkwall; *Secretary*, John Cumming, Sebay, St Andrews, Orkney. Granted 1898.

£3 to West Mainland, Orkney.—*Convener*, W. G. T. Watt, Skaill House, Stromness; *Secretary*, William A. Ironside, Bankhead, Sandwick, Stromness. Granted 1900.

£3 to Sanday, Orkney.—*Convener*, W. Cowper Ward, Scar House, Sanday, Orkney; *Secretary*, R. H. Sinclair, Kettletoft, Sanday, Orkney. Granted 1902.

North of Scotland Root, Vegetable, &c.—*Convener*, John Maitland, East Balhalgardy, Inverurie; *Secretary*, James Eddie, Freefield, Insch. 4 Medals. Granted 1899.

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society, being anxious to co-operate with local Associations, will give a limited number of Silver Medals annually to Societies, not on the list of Cattle, Horse, or Sheep Premiums, in addition to the Money Premiums awarded in the Districts for—

1. Best Bull, Cow, Heifer of any pure breed, or Ox.
2. Best Stallion, Mare, or Gelding.
3. Best Tup, or Pen of Ewes or Wethers.
4. Best Boar, Sow, or Pig.
5. Best Pens of Poultry.
6. Best Sample of any variety of Wool.
7. Best Sample of any variety of Seeds.
8. Best managed Farm.
9. Best managed Green Crop.
10. Best managed Hay Crop.
11. Best managed Dairy.
12. Best Sweet-Milk Cheese.
13. Best Cured Butter.
14. Best collection of Roots.
15. Best kept Fences.
16. Male Farm Servant who has been longest in the same service, and who has proved himself most efficient in his duties, and to have invariably treated the animals under his charge with kindness.
17. Female Servant in charge of Dairy and Poultry who has been longest in the same service, and who has proved herself most efficient in her duties, and to have invariably treated the animals under her charge with kindness.
18. Best Sheep-Shearer.
19. Most expert Hedge-Cutter.
20. Most expert Labourer at Draining.
21. Most expert Farm Servant at trial of Reaping-Machines.
22. Best Maker of Oat-Cakes.

It is left to the local Society to choose out of the foregoing list the classes for which the Medals are to be competed.

The Medals are granted for two years, and lapse if not awarded in those years.

In 1889 it was resolved that in future no Society shall receive more than two Medals for two years.

Aberdeenshire.

1. Central Deeside.—*Convener*, Lieut.-Col. F. N. Innes of Learney, Torphins; *Secretary*, James M'Laggan, The Bank, Torphins. 2 Medals. 1902.
2. Cromar, Upper Dee, and Donside.—*Convener*, Sir John Forbes Clark, Bart., Tillypronie, Tarland; *Secretary*, William Thomson, Town and County Bank, Tarland. 2 Medals. 1901.
3. Monquhitter.—*Convener and Secretary*, James Cowie, Haremoss, Turriff. 2 Medals. 1902.
4. Upper Donside.—*Convener*, James M'Donald, Mossat, Kildrummy; *Secretary*, John Milne, Town and County Bank, Kildrummy, Mossat. 2 Medals. 1901.

Argyllshire.

5. MULL AND MORVERN.—*Convener*, J. H. Munro Mackenzie of Calgary, Tobermory; *Secretary*, D. M. Mackinnon, Solicitor, Tobermory. 2 Medals. 1902.
6. NETHER LORN.—*Convener*, John S. Blair, Melfort, Oban; *Secretary*, Donald Mackintosh, Kilbrandon Estate Office, Oban. 2 Medals. 1902.
7. OBAN POULTRY CLUB.—*Convener*, ; *Secretary*, James D. MacTaggart, Glenmore, Oban. 2 Medals. 1901. (In abeyance in 1901.)

Ayrshire.

8. ARDROSSAN.—*Convener*, Joseph Russell of Seafield, Ardrossan; *Secretary*, Arthur Craig, Solicitor, Ardrossan. 2 Medals. 1902.
9. BEITH.—*Convener*, David Kerr, Park, Beith; *Secretary*, Matthew Gilmour, Clydesdale Bank, Beith. 2 Medals. 1902.
10. COLMONELL AND BALLANTRAE.—*Convener*, Robert F. M'Ewen of Bardrochet, Colmonell; *Secretary*, Andrew M'Credie, Union Bank, Barrhill. 2 Medals. 1901.
11. DALRYMPLE.—*Convener*, William Millar, Nile Court, Ayr; *Secretary*, John Murchie, Netherton, Dalrymple. 2 Medals. 1902.
12. PATNA.—*Convener*, Robert Lees, Lagg, Ayr; *Secretary*, William Dunn, Hoodstone, Dalrymple. 2 Medals. 1900. (Held no Show in 1901.)

Banffshire.

13. NORTHERN SEEDS AND ROOTS.—*Convener*, George Bruce, Tochineal, Cullen; *Secretary*, George Pirie, South High Street, Portsoy. 2 Medals. 1902.

Berwickshire.

14. LAUDERDALE.—*Convener*, John Mackay, Wyndhead, Lauder; *Secretary*, George L. Broomfield, Solicitor, Lauder. 2 Medals. 1902.

Dumfriesshire.

15. SANQUHAR.—*Convener*, W. E. Paterson, Craigdarroch, Sanquhar; *Secretary*, William Murray, British Linen Co. Bank, Sanquhar. 2 Medals. 1900. (In abeyance in 1900.)

Elginshire.

16. MORAYSHIRE.—*Convener*, H. M. S. Mackay, Bank Agent, Elgin; *Secretary*, W. Rose Black, Solicitor, Elgin. 2 Medals. 1902.

Fifeshire.

17. KINGLASSIE.—*Convener*, William Meiklem, Begg, Kirkcaldy; *Secretary*, William Ness, Walkerton, Leslie, Fife. 2 Medals. 1902.

Inverness-shire.

18. GLEN-URQUHART.—*Convener and Secretary*, Angus Grant, Drumalan, Drumnadrochet. 2 Medals. 1902.

Stewartry of Kirkcudbright.

19. Dalry Horticultural Bird and Poultry. — *Convener*, D. M. Henderson, Dalry, Galloway; *Secretary*, James Stewart, Dalry, Galloway. 2 Medals. 1901.

Lanarkshire.

20. Avondale. — *Convener*, John Fleming, Meadowbank, Strathaven; *Secretary*, Robert M'Cowan, Bank of Scotland, Strathaven. 2 Medals. 1901.
21. Biggar. — *Convener*, R. G. Murray of Spittal, Biggar; *Secretary*, Thos. B. Murray, Spittal, Biggar. 2 Medals. 1902.
22. Carmunnock. — *Convener*, Patrick Graham of Killochside, Busby; *Secretary*, Wm. Fleming, Windlaw, Carmunnock. 2 Medals. 1901.
23. New Monkland.—*Convener*, John W. Findlay, Bank Street, Airdrie; *Secretary*, John A. White, Royal Bank, Airdrie. 2 Medals. 1901.
24. Shotts Calderwaterhead.—*Convener*, Colonel Forrest of Hairmyres, Shotts; *Secretary*, Alex. Waddell, 34 Moir Street, Glasgow. 2 Medals. 1901.

Perthshire.

25. Middle District of Atholl. — *Convener*, James J. Gillespie, St Colmes, Ballinluig; *Secretary*, J. S. Grant, Ballinluig. 2 Medals. 1901.

Renfrewshire.

26. Cathcart and Eastwood.—*Convener*, J. Campbell Murray, Haggs Castle, Pollokshaws; *Secretary*, J. M. Campbell, Auldfield Place, Pollokshaws. 2 Medals. 1901.

Ross-shire.

27. Dingwall Poultry Show.—*Convener*, Sir Hector Munro of Foulis, Bart., Dingwall; *Secretary*, William Sinclair, Athole Court, Dingwall. 2 Medals. 1901. (In abeyance in 1901.)

Stirlingshire.

28. Denny and Dunipace.—*Convener*, James Risk, Bankier, Castlecraig, N.B.; *Secretary*, Alexander Hendry, Solicitor, Denny. 2 Medals. 1902.
29. Slamannan. — *Convener*, William Rennie, Parkhead, Slamannan; *Secretary*, Angus A. M'Lean, Castlehill, Slamannan. 2 Medals. 1901.

Applications from other Districts must be lodged with the Secretary of the Society *by 1st November next.*

RULES OF COMPETITION.

1. All Competitions must be at the instance of a local Society.
2. The classes for which Medals are granted must be in accordance with the list at page 45. The Committee shall select the classes, and specify them in the return.
3. A Committee of Management shall be appointed, and the Convener

of the Committee must be a Member of the Highland and Agricultural Society.

4. The Money Premiums given in the District must be not less than £2 for each Medal claimed.

5. The Medal for Sheep-Shearing shall not be awarded unless there are three competitors, and it shall always accompany the highest Money Premium. There must not be fewer than two competitors in all the classes.

6. Blank reports will be furnished to all the Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary of the Highland and Agricultural Society *on or before the 1st of November next*, with the exception of green crop reports, which must be forwarded on or before the 20th of December, for the approval of the Directors, against whose decisions there shall be no appeal.

7. When a grant has expired, the District shall not be eligible to apply again for aid for two years; and if no competition takes place in a District for two years, the grant shall expire.

PLOUGHING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first Premium at Ploughing Competitions, provided a Report in the following terms is made to the Secretary, within one month of the Competition, by a Member of the Society:—

FORM OF REPORT.

I, of , Member of the Highland and Agricultural Society, hereby certify that I attended the Ploughing Match of the Association at in the county of on the when ploughs competed; of land were assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:—

[*Here enumerate the names and designations of successful Competitors.*]

RULES OF COMPETITION.

1. All Matches must be at the instance of a local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society, 3 George IV. Bridge, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match; and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve ploughs in Competition, and not less than Three Pounds awarded in Prizes by the local Society. The Medal to be given to the winner of the first prize.

7. Ploughmen shall not be allowed any assistance, and their work must not be set up nor touched by others; and attention should be given to

the firmness and sufficiency of the work below more than to its neatness above the surface.

8. The Local Committee is required to fix the time to be allowed for ploughing the portion of land, and they are recommended that the time be at the rate of not more than ten hours per imperial acre on light land, and fourteen hours on heavy or stony land.

CLASS III.

COTTAGES AND GARDENS.

The following Premiums are offered for Competition in the Parishes after mentioned.

The Premiums are granted for two years.

PREMIUMS FOR BEST KEPT COTTAGES AND GARDENS.

1. Best kept Cottage	. . . . .	£1 0 0
Second best	. . . . . .	0 10 0
2. Best kept Cottage Garden	. . . .	1 0 0
Second best	. . . . . .	0 10 0

RULES OF COMPETITION.

1. Competitions may take place in the different parishes for Cottages and Gardens, or for either separately.

2. The occupiers of Lodges at Gentlemen's Approach Gates and Gardeners' Houses are excluded, as well as others whom the Committee consider, from their position, not to be entitled to compete. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judges.

3. It is left to the Committee of the District to regulate the maximum annual rent of the Cottages, which may, with the garden, be from £5 to £7.

4. To warrant the award of full Premiums, there must not be fewer than three competitors in each class. If there are less than three competitors in each class, only half Premium will be awarded.

5. A person who has gained the highest Premium cannot compete again.

6. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is thatch, it must be in good repair, though in the occupation of a tenant. The interior and external conveniences must be clean and orderly; the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

7. In estimating the claims for the Garden Premiums, the judges should have in view—the sufficiency and neatness of the fences and walks; the cleanness of the ground; the quality and choice of the crops; and the general productiveness of the garden.

8. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them,

must be transmitted by the Conveners to the Secretary *on or before the 1st November next.*

9. When a grant has expired, the District cannot apply again for aid for two years.

Parishes desirous of these Premiums must lodge applications with the Secretary *on or before the 1st November next.*

MEDALS FOR COTTAGES AND GARDENS OR GARDEN PRODUCE AND BEE-KEEPING.

The Society will issue annually two Minor Silver Medals to a limited number of local Associations or individuals, who at their own expense establish Premiums for Cottages and Gardens under £15 of Rent. One of the Medals may be awarded for the best kept Cottage, and the other for either the best kept Garden, Flower-Plot, or Garden Produce, the produce of the cottager's own garden. Two Minor Silver Medals will also be issued to Local Bee-Keeping Associations.

Local Associations or individuals desirous of these Medals, must lodge applications with the Secretary *on or before the 1st November next.*

The Medals are granted for two years.

Argyllshire.

1. MULL AND MORVERN.—*Convener*, Mrs Fletcher of Glenaros, Isle of Mull; *Secretary*, Archibald Maclachlan, Salen, Aros. 2 Medals. 1899. (1 Medal for 1901, 1 Medal not offered in 1900.) No Competition held in 1901.

Ayrshire.

2. DARVEL BEE-KEEPERS.—*Convener*, Hugh Morton, Townfoot, Darvel; *Secretary*, Nicol Smith, Donington Street, Darvel. 2 Medals. 1902.

Edinburghshire.

3. CURRIE.—*Convener*, Sir James H. Gibson-Craig of Riccarton, Bart., Currie; *Secretary*, Marshall Bryce, Currie. 2 Medals. 1901.

Fifeshire.

4. STRATHMIGLO.—*Convener*, R. D. Thom, Pitlochie, Strathmiglo; *Secretary*, Alex. Sharp, Skene Street, Strathmiglo. 2 Medals. 1901.

Haddingtonshire.

5. STENTON.—*Convener*, Rev. George Marjoribanks, Manse of Stenton, Prestonkirk; *Secretary*, George Scott, Stenton. 1 Medal. 1902.

Lanarkshire.

6. CARNWATH HORTICULTURAL.—*Convener*, William Fleming, Calla, Carnwath; *Secretary*, Geo. C. Murray, The Schoolhouse, Carnwath. 2 Medals. 1901.
7. CARNWATH BEE-KEEPERS.—*Convener*, John Robertson, Commercial Bank, Carnwath; *Secretary*, Geo. C. Murray, Schoolhouse, Carnwath. 2 Medals. 1902.
8. LAW.—*Convener*, Isaac Thompson, Curatehill Cottage, Law; *Secretary*, Quintin Macfadyen, Burnside Cottage, Law, Carluke. 2 Medals. 1902.

Nairnshire.

9. AULDEARN AND ARDCLACH.—*Convener*, James Russell, Blackhills, Nairn; *Secretaries*, A. J. Mackintosh, Auldearn, and F. Duff, Kindeary, Auldearn. 2 Medals. 1901.
10. CAWDOR.—*Convener*, John S. Robertson, Constabulary Gardens, Nairn; *Secretary*, David Reid, jun., Cawdor, Nairn. 2 Medals. 1902.

Perthshire.

11. BLAIRGOWRIE AND RATTRAY.—*Convener*, ; *Secretary*, D. G. Monair, Elmbank, Blairgowrie. 2 Medals. 1901. (In abeyance in 1901.)
12. COUPAR-ANGUS.—*Convener*, David Buttar, Corston, Coupar-Angus; *Secretary*, James Simpson, 46 Causewayend, Coupar-Angus. 2 Medals. 1901.
13. DUNBLANE.—*Convener*, Alex. B. Barty, Solicitor, Dunblane; *Secretary*, H. R. Hume, Helenslee, St Mary's Drive, Dunblane. 2 Medals. 1902.
14. LOGIEALMOND AND GLENALMOND.—*Convener*, Earl of Mansfield, Scone Palace, Perth; *Secretary*, John G. M'Laggan, Lethendy Cottage, Glenalmond, Perth. 2 Medals. 1902.
15. MUTHILL.—*Convener*, R. T. N. Speir of Culdees, Muthill; *Secretary*, John White, jun., Wardside, Muthill. 2 Medals. 1901.

Renfrewshire.

16.—BRIDGE OF WEIR.—*Convener*, R. S. Milne, Royston, Bridge of Weir; *Secretary*, Peter Candlish, Benvue, Bridge of Weir. 2 Medals. 1902.

Wigtownshire.

17. PORT-WILLIAM.—*Convener*, C. M. Routledge, Port-William; *Joint-Secretaries*, W. M'D. Selby and W. Dickson, Port-William. 2 Medals. 1901. (In abeyance in 1901.)

REGULATIONS.

1. Competitions may take place in the different districts for Cottages and Gardens, or for either separately. The one Medal may be offered for Cottages, and the other for Gardens, Flower Plots, or Garden Produce, but the two cannot be given in one class.

2. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, must not exceed £15. The occupiers of Lodges at Gentlemen's Approach Gates, and Gardeners in the employment of others, are not entitled to compete.

3. If Competition takes place for Garden Produce in place of the best kept Garden or Flower Plot, such produce must be *bona fide* grown in the Exhibitor's Garden, and he will not be allowed to make up a collection from any other Garden.

4. To warrant the award of a Medal, there must not be fewer than three Competitors.

5. Blank reports will be furnished to the Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary of the Highland and Agricultural Society *on or before the 1st November next*, for the approval of the Directors, against whose decisions there shall be no appeal.

6. When a grant has expired, the District cannot apply again for aid for two years, and if no competition takes place in a District for two years the grant expires.

FIRST EDITION.]

Address for Telegrams—"SOCIETY," EDINBURGH.

Subject to Orders issued by the Board of Agriculture

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

GENERAL SHOW OF STOCK AND IMPLEMENTS

ON THE LINKS,

ABERDEEN,

ON 15TH, 16TH, 17TH, AND 18TH JULY 1902.

LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Monday, 12th May.

STOCK, POULTRY, AND DAIRY PRODUCE—Monday, 9th June.

No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Monday morning (9th June). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (11th June), at the Society's Office, Edinburgh, at 10 o'clock.

COVERED BOOTHS FOR OFFICES—Monday, 9th June.

President of the Society.

THE RIGHT HON. THE EARL OF ABERDEEN.

Chairman of the Board of Directors.

SIR RALPH ANSTRUTHER OF BALCASKIE, BART.

Convener of the Local Committee.

A. M. GORDON OF NEWTON.

The District connected with the Show comprises the Counties of Aberdeen, Banff, Forfar (Eastern Division), and Kincardine.

REGULATIONS.

GENERAL CONDITIONS.

1. The Competition, except where otherwise stated, is open to Exhibitors from all parts of the United Kingdom.

2. Every Lot must be intimated by a Certificate of Entry, lodged with the Secretary *not later than Monday, 12th May, for Implements and other* ***Entries.***

Articles, and Monday, 9th June, for Stock, Poultry, and Dairy Produce. No Entry taken at ordinary fees later than those which are received at the Society's Office by first post, or 10 o'clock, on Monday morning, 9th June. Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (11th June), at the Society's Office, Edinburgh, at 10 o'clock. Printed forms of Entry will be issued on application to the Secretary, No. 3 George IV. Bridge, Edinburgh. Admission Orders will be forwarded to Exhibitors, by post, previous to the Show.

Protests. 3. Protests against the awards of the Judges, or against a violation of the judging regulations, must be lodged with the Secretary, at his Office in the Showyard, not later than 9 A.M. on Wednesday, the second day of the Show, and parties must be in attendance at the Secretary's Office, in the Showyard, at 9.30 A.M. that day, when protests will be disposed of. All protests must be accompanied by a deposit of £2, 2s., and if not sustained the sum may be forfeited at the discretion of the Directors.

4. Protests lodged for causes which the protester produces no good evidence to substantiate will render him liable to be reported to the Board of Directors, with the view, if they see reason, of his being prohibited from again entering Stock for a General Show.

Society not liable. 5. The Society shall not be liable for any loss or damage which Stock, Poultry, Dairy Produce, Implements, or other articles may sustain at the Show, or in transit.

Rejecting Entries. 6. The Society reserves the right to reject or cancel any entry or prohibit the exhibition of any entry.

Decisions of Board. 7. The decisions of the Board of Directors are final in all questions respecting Premiums and all other matters connected with the Show, and it shall not be competent for any Exhibitor to appeal against such decisions to, nor seek redress in respect of them from, any other tribunal.

Covered Booths. 8. Covered Booths for Offices (9 feet by 9 feet), purely for business, not for exhibition of goods, can be had for £3, 10s. to Members and £5 to Non-Members. Intimation to be made to the Secretary on or before the 9th of June. Those applying after that date to pay double Entry Money, but no application can be received later than 14th June.

Lights and Smoking. 9. No lights allowed in the Yard at night, and Smoking is strictly prohibited within the Sheds. Those infringing this Rule shall be liable to a fine of 10s.

Water. 10. As the command of water in the Yard is limited, it is particularly requested that waste be avoided.

Subjection to Rules. 11. All persons admitted into the Showyard shall be subject to the Rules and Orders of the Directors.

Powers of Stewards. 12. The Stewards have power to enforce the Regulations of the Society in their different departments, and to bring to the notice of the Directors and Secretary any infringement thereof.

Attendants. 13. All persons in charge of Stock or other Exhibits shall be subject to the orders of the Secretary and Stewards.

Violation of Rules. 14. The violation by an Exhibitor of any one of the Regulations shall render him liable to the forfeiture of all Premiums awarded to him, or of such a portion as the Directors may ordain, and also liable to be disqualified from again, or for a certain number of years, exhibiting at the Shows of the Society; or to have his case otherwise disposed of as the Directors may determine.

Railway Passes. 15. Railway Certificates for Stock and Implements are issued to Exhibitors before the Show along with their Tickets of Admission, one Certificate for the outward and another for the return journey being sufficient for each Exhibitor for any number of exhibits.

Removal of Exhibits. 16. No animal or article can be withdrawn before the formal closing of

the Show at 5 P.M. on Friday; Steam Engines not till 6 o'clock. Stock and Implements may remain in the Yard till Saturday afternoon.

17. The Premiums awarded, except those withheld till birth of calf or foal is certified, will be paid as soon after the Show as practicable, and, with the exception of the Tweeddale Gold Medal, Special Cups, and Medals, may be taken either in money or in plate. *Payment of Prizes.*

STOCK AND POULTRY.

18. Poultry and Stock will be admitted on Monday, the day before the opening of the Show, and, with the exception of Horses, must be in the Yard before 12 o'clock that night. Horses must be in before 8 o'clock on the morning of Tuesday, except those entered for Jumping only, regarding which special Regulations will be found beside the list of prizes for Jumping. Judging begins at 10 A.M. on Tuesday. Exhibited on Tuesday, Wednesday, Thursday, and Friday. Stock may be admitted on the Saturday preceding the Show, but only by sending two days' prior notice to the Secretary. *Admission of Stock.*

19. An animal which has gained a first Premium at a General Show of the Society cannot again compete in the same class, notwithstanding any alteration in the heights stated for such class, but may be exhibited as Extra Stock. *Former Winners.*

20. All animals, except calves, foals, and lambs shown with their dams, must be entered in the classes applicable to their ages, and cannot be withdrawn after entry, or other animals be substituted in their place. *No substitution of animals.*

21. For prizes given by the Society, no animal shall be allowed to compete in more than one class; but this Rule does not apply to the Jumping and Driving Competitions. *One class only.*

22. Shorthorn, Aberdeen-Angus, Galloway, and West Highland animals must be entered in the herd-books, or the Exhibitor must produce evidence that his animal is eligible to be entered therein. *Herd-books.*

23. Stock must be *bona fide the property of* the Exhibitor on the last day of Entry. *Ownership.*

24. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor. The Society shall have power at any time to call upon an Exhibitor to furnish proof of the correctness of any statement in his entry.

25. The name of the Breeder, if known, must be given, and if the Breeder is not known, a declaration to that effect, signed by the Exhibitor, must be made on the Entry Schedule, and no pedigree will be entered in the Catalogue when the Breeder is unknown. *Particulars of entries.*

26. Should it be proved to the satisfaction of the Directors that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Directors or Judges as to its qualification or properties, or that information required in the Schedule and known or easily ascertained by the Exhibitor has been withheld, such animal may be disqualified either before or after a prize has been awarded to it, and the case may be reported to the Directors, in order that the Exhibitor may be disqualified from again competing at the Society's Shows, or his case otherwise disposed of as the Directors may determine. *Entries disqualified.*

27. When an animal has previously been disqualified by the decision of any Agricultural Association in the United Kingdom, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity. Any person who is disqualified from exhibiting at any Show in the United Kingdom shall be prohibited from exhibiting at

any General Show of the Society, unless with the special consent of the Board.

Height of Horses. 28. All Horses or Ponies entered in classes in which a particular height is stated shall before being judged be measured with their shoes on. No subsequent measuring or alteration of shoes will be permitted.

Overfeeding. 29. Breeding Stock must not be shown in an improper state of fatness, and the Judges are requested not to award Premiums to overfed animals; and no Cattle or Sheep which have been exhibited as Fat Stock at any Show are eligible to compete in the Breeding Classes for the Society's Prizes.

Parades. 30. Horses and Cattle must be paraded at the times stated in the Programme of the Show, and when required by the Stewards, and under their direction. In Parade, Horses must be ridden or led as provided in their respective classes. Prize and commended animals will receive two rosettes each, which must be attached to the head of the animal, one on each side. Attendants must be beside their animals *twenty minutes before the hour of Parade*, and be ready to proceed to the ring immediately on receiving the order of the Stewards. Infringement of this Rule, or failure of any attendant to obey the orders of the Society's officials, will render the Exhibitor liable to a fine of 20s. for each separate infringement or act of disobedience, and to the forfeiture of any or all of the Prizes awarded to him at this Show.

Responsibility of Exhibitors. 31. Exhibitors shall be answerable for all acts, whether committed by themselves, their servants, or others in charge of their Stock, and shall be responsible for the condition of their animals during the whole time they remain in the Showyard.

Moving from stalls. 32. No animal shall be taken out of its stall after 10 A.M. during the Show except by order of the Stewards, or with permission of the Secretary.

Washing Cattle. 33. Cattle shall not be taken out of their stalls to be washed after the Judging has been finished. Those infringing this Rule shall be liable to a fine of 10s.

Soaping prohibited. 34. Soap or other adhesive material must not be used in dressing cattle or horses. Infringement of this Rule will render the animal upon which the material is used liable to be disqualified.

Sires. 35. Aged Bulls and Stallions must have had produce, and, along with two-year-old Bulls, three-year-old Colts, and two-shear and aged Tups, have served within the twelve months immediately preceding the Show.

Cows. 36. All Cows must have had calves previous to the Show. When exhibited, Highland Cows must be in milk or have calf at foot, and have had a calf within 9 months of the Show. Cows of other breeds, when exhibited, must either be in milk or in calf: if in milk, birth must have been within 9 months of the Show; if in calf, birth must be certified within 9 months after the Show. Animals of any age that have had a calf must be shown as Cows.

In-calf Heifers. 37. Two-year-old Heifers of the Shorthorn, Aberdeen-Angus, and Galloway breeds, two-year-old Yeld Ayrshire Heifers, and three-year-old Highland Heifers, must be in calf when exhibited, and the Premiums will be withheld till birth be certified, which must be within 9 months after the Show.

Mares. 38. A Mare entered in a class for "Mares with foal at foot" must have produced a foal after 1st January of the year of the Show, must have regularly nursed her own or another foal, and must have the foal with her in the Show. If the mare's own foal is alive it must be the foal shown with the mare. In the case of a Mare that has not foaled before the Show, or whose foal has died, she shall, if not in milk, be eligible without further entry to compete among the Yeld Mares. Agricultural Yeld Mares must produce a foal within 12 months from the first day

of the Show. A Mare in a class for "Mares or Geldings" may or may not have had a foal in the year of the Show, but shall not have her foal exhibited with her, nor be in milk at the time of the show.

39. With reference to Regulations 34, 35, and 36, birth of at least a seven months' calf must be certified; and in regard to Regulation 38, birth of at least a nine months' foal; or in the case of death, a Veterinary Surgeon's certificate must be produced certifying that at the time of death the animal was so far advanced with calf or foal that if it had lived it would have produced a calf or foal, as required by Rules 34, 35, 36, 38, and 39. *Calves and Foals.*

40. Except when otherwise provided the awards of Special Prizes shall not be subject to the Regulations as to calving and foaling. *Special Prizes.*

41. Any artificial contrivance or device of any description found on or proved to have been used on an animal, either for preventing the flow of milk or for any other improper purpose, will disqualify that animal from being awarded a Premium, and the Owner of said animal shall be prohibited from again entering Stock for any of the Society's General Shows, for such a period as the Directors may see fit. *Tampering with animals.*

42. During the time the Show is open to the public no rug shall be hung up so as to conceal any animal in a horse-box or stall, except with the special permission of the Steward of that department. *Concealing animals.*

43. In the classes for Hunters four years old and upwards the Judges are empowered to transfer to the proper classes horses which, in regard to weight-carrying, are in their opinion entered in the wrong classes. *Hunters.*

44. Judges are particularly requested to satisfy themselves, as far as possible, regarding the soundness of all Horses before awarding the Prizes, and to avoid giving Prizes to animals showing symptoms of hereditary diseases. The Judges may consult the Society's Veterinary Surgeon if they deem it expedient. No protests on veterinary grounds will be received. *Soundness of Horses.*

45. All Ewes must have reared lambs in the year of the Show; and Ewes of the Blackfaced and Cheviot breeds must be in milk, and have their lambs at foot. *Ewes.*

46. Sheep must have been clipt bare after 1st January of the year of the Show, and the Judges are instructed to examine the fleeces of the Sheep selected for Prizes, and to cast those on which they find any of the former fleece. This Rule does not apply to Cheviot sheep. *Clipping.*

47. Sows must have reared pigs in the year of the Show or be in pig; and Pigs must belong to the same litter, and be uncut. *Sows.*

48. In Poultry the Aged Birds must have been hatched previous to, and Cockerels and Pullets in, the year of the Show. *Poultry.*

49. Bulls must be secured by nose-rings, with chains or ropes attached, or with strong halters and double ropes. All Cattle, other than Highland Cattle, must be tied in their stalls. *Securing Cattle.*

50. Servants in charge of Stock must bring their own buckets or pails, and a piece of rope or sheep-net to carry their forage. Mangers, sheep and pig troughs, will be provided. *Feeding appliances.*

51. Loose-boxes will be provided for Stallions, three, two, and one year-old entire Colts; for two- and one-year-old Fillies, and for Mares with foals at foot; closed-in stables for all the other Horses, and covered accommodation for the whole of the other Live Stock. In no case, either in the ordinary classes or "Extra Stock," will a box be provided except for the classes here specified. Stalls (floored) for attendants on Cattle, Horses, and Sheep will be provided at same rates as those charged for Stock. *Accommodation for animals.*

52. Five days' supply of straw, hay, grass, and tares will be provided free by the Society. Any additional fodder or other kinds of food *Fodder.*

required will be supplied at fixed prices in the Forage-yard. Any servant removing bedding from an adjoining stall will be fined in double the amount taken. Exhibitors may fetch their own cake or corn to the Yard, but not grass, tares, hay, or straw. Sawdust must not be used as bedding for Stock. Coops, food, and attendance for Poultry will be provided by the Society.

Removal. 53. Cattle, Sheep, Swine, or Poultry cannot be removed from the Yard till 5 P.M. on Friday, the last day of the Show, except on certificate by the Veterinary Surgeon employed by the Directors, countersigned by the Steward of the department or the Secretary.

Withdrawal of horses over night. 54. Horses may be withdrawn at the close of the Show on Tuesday, Wednesday, and Thursday, on a deposit of £5 for each animal, which shall be forfeited, along with any prize money it may have gained, if the animal is not brought back. They must return between 7 and 7.30 the following morning, and those not in before 8 shall forfeit 10s. Horse passes to be applied for at the Secretary's Office between 5 and 6 P.M. on Tuesday, and the deposit, unless forfeited in whole or in part, will be returned between 12.30 and 2.30 on Friday.

Order in removal. 55. When the Stock is leaving the Yard, no animal is to be moved till ordered by those in charge of clearing the Yard. Those transgressing this Rule shall be liable to a fine of 10s., and detained till all the other Stock is removed.

Penning and removing Poultry. 56. Poultry may be penned before the opening and removed at the close of the Show by Exhibitors themselves or their representatives. In the event of neither the Exhibitor nor an authorised representative of the Exhibitor being present to pen or remove Poultry, the birds will be penned and removed by men hired by the Society, but this will be done on the understanding that the men are hired to do the work on behalf of Exhibitors, and solely at their risk, and that the Society will be in no way responsible for expenses incurred or loss of or injury to Exhibits by errors or accidents in penning, despatching, or conveying Exhibits.

Closing of Poultry Shed. 57. On the opening day of the Show the Poultry Shed will be closed to the public during the Judging. On the last day of the Show the Poultry Shed will be closed to the public at 4 P.M.; at 5 P.M. Exhibitors or their representatives will be admitted to the Shed to remove Exhibits, provided the Exhibitor has, *not later than* 11 A.M. *on the last day of the Show,* given written notice to the Secretary to the effect that the Exhibitor or the Exhibitor's representative will attend at the Poultry Shed at 5 P.M. to remove the birds.

JUDGING STOCK AND POULTRY.

Opening Gates. 58. On Tuesday, the first day of the Show, no person will be admitted, except Servants in charge of Stock, till 8 A.M., when the Gates are opened to the public.

Judging. 59. The Judges will commence their inspection at 10 A.M. The spaces reserved for the Judging will be enclosed, and no encroachment shall be permitted.

Insufficient merit. 60. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit; and where only one or two lots are presented in a section, and the Judges consider them unworthy of the Premiums offered, it shall be in their power to award a lower prize, or to suggest the removal of any lot which appears to them unworthy of a place in the Yard.

Commendations. 61. In addition to the Premiums, the Judges are authorised to award three Commendations in each section, if the entries are numerous and the animals of sufficient merit. These Commendations consist of—Very Highly Commended, Highly Commended, and Commended.

62. Ayrshire Cows which have not calved before the Show, whether entered in the class for Cows in Milk or for Cows in Calf, shall be judged along with the Cows in Calf, and Ayrshire Cows or Heifers which have calved before the Show—in whichever of the two classes entered—shall be judged along with Cows in Milk. *Ayrshire Cows and Heifers.*

63. One Member of Committee and one or two Directors shall attend each section of the Judges. It will be their duty to bring the animals out to the Judges and to see that no obstruction is offered to them, and that the space reserved for them is not encroached upon; to ticket the prize animals; to send the Nos. of prize animals to the Award Lectern near the Secretary's office; to assist the Judges in completing their return of awards; and should any difficulty arise, to communicate with the Stewards or Secretary. *Attending Members.*

64. It shall not be competent for any Exhibitor, nor for his Factor or Land-Steward, to act as a Judge or attending Member in any class in which he is competing.

DAIRY PRODUCE.

65. Dairy Produce will be received in the Showyard on Monday, the day before the opening of the Show, and till 8 A.M. on Tuesday, the first day of the Show. Judged at 10 A.M. on Tuesday. Exhibited Tuesday, Wednesday, Thursday, and Friday.

66. Dairy Produce must have been made on the Exhibitor's farm this year. No Exhibitor shall show more than one lot in each class. No lot can be removed from the Yard till 5 P.M. on Friday, the last day of the Show. The Society undertakes no responsibility for the receipt or despatch of exhibits, nor for the loss of exhibits, nor for any injury they may sustain during the Show.

STALL RENT (INCLUDING ENTRY FEE).

67. The following rates (which include Entry Fees and Stall Rent) shall be paid by Exhibitors when making their Entries:—

	Members		Non-Members.	
	s.	*d.*	*s.*	*d.*
Stalls for Cattle, each	15	0	25	0
Boxes for Horses in Classes 37, 38, 39, 44, 52, 53, 54, 58, and 59	30	0	40	0
Boxes for Horses in Classes 40, 47, 48, 49, 50, 56, 57, 60, 61, 62, 65, 67, 68, 70, 71, and 72	22	6	32	6
Stalls for Horses in Classes 41, 42, 43, 45, 46, 51, 55, 75, and 76	20	0	30	0
Stalls for Horses in Classes 63, 64, 66, 69, 73, and 74	15	0	20	0
Shed Accommodation for Machines for driving competitions, each	5	0	10	0
Sheep or Swine, per pen	10	0	15	0
Wool, per entry	2	6	5	0
Poultry, each entry	2	0	3	0
Dairy Produce, each entry	4	0	6	0
Covered Booths for offices, 9 feet by 9 feet	70	0	100	0
Newspaper offices . . £2, 10s.				

Entries in more than one Class.—In the case of animals entered in more than one class, the entry fee shall be five shillings for each class after the first. This does not apply to the Jumping Competitions.

EXTRA STALL FOR ATTENDANTS.

68. Exhibitors of Stock shall be entitled to take an extra Stall or Box for the accommodation of their attendants, but they must state when making their Entry that the Stall or Box is to be used for that purpose, and remit rent, which is at the same rate as stated above for the particular class of stock. They must also state next to which animal they wish the attendant's accommodation to be placed.

IMPLEMENTS AND OTHER ARTICLES.

Admission. 69. Implements will be received in the Yard from Tuesday, 8th July, till 5 o'clock on the afternoon of Monday, 14th July. Exhibited Tuesday, Wednesday, Thursday, and Friday. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor, and prices must be stated.

Premiums. 70. No Money Prizes or Medals, except when specially offered, will be given by the Society for Implements of any kind.

Refusing Entries. 71. Agricultural Implements, and Implements and collections of articles not Agricultural, will be received for Exhibition, but the Secretary is entitled to refuse Entries from dealers in articles not deemed worthy of Exhibition.

Local Operatives. 72. In order to encourage exhibits of Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show, open space will be provided for these in some less prominent part of the Yard at a charge of 10s. for space 10 feet wide and 20 feet deep.

Order of Implements. 73. Implements will be entered in the following sections—viz., 1st, Space without Shedding, 20 feet deep; 2nd, Shedding, 20 feet deep, 7 feet high to eave; 3rd, Shedding, 20 feet deep, 7 feet high to eave, boarded at back; 4th, Motion Yard, without Shedding, 50 feet deep; 5th, Motion Yard, 50 feet deep, with Shedding, 20 feet wide, 10 feet high to eave; 6th, Open space for Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show. Exhibitors must specify the space they require.

Articles not entered. 74. Every article to be exhibited must be entered on the Society's Entry Form. Any article not so entered that is taken to the Show is liable to be ordered out of, or removed from, the Showyard, or confiscated to the Society. Exhibitors infringing this rule are moreover liable to a fine of £1.

Selling by auction and noisy behaviour forbidden. 75. "Cheap-Jacks" are not admitted to the Showyard. The selling of goods by auction, shouting, and other behaviour calculated to annoy visitors or Exhibitors, are strictly forbidden. Exhibitors infringing this Regulation are liable to a fine of £1, and to have themselves and their goods ordered out of, or removed from, the Showyard, or to have their goods confiscated to the Society.

Placing Exhibits. Removing Exhibits. 76. The articles of each Exhibitor must be all placed in one stand, except Implements in motion, and must not on any account extend beyond the allotted space. No article shall be moved out of its stand, or the stand dismantled, till the termination of the Show, at 5 P.M. on Friday. Those infringing this Rule shall be liable to a fine of 10s.

Restoring Turf. 77. When the ground requires to be broken, the turf must be carefully lifted and laid aside, and the surface must be restored to the satisfaction of the Society, and at the expense of the Exhibitor. Failing this being done, the Society shall be at liberty to restore the ground and charge the cost to the Exhibitor.

Arranging Exhibits. 78. Exhibitors must arrange their own articles *within* the space allotted to them before 9 o'clock on Tuesday, and to the satisfaction of the Stewards in charge of the Implement Yard.

79. Exhibitors are not allowed to distribute handbills anywhere in the Yard except at their own Stand; and they must not for this or any other purpose encroach upon the adjacent alleys or open spaces. *Handbills.*

80. Exhibitors are required to have their Stands and the portions of the alleys immediately adjoining them swept up before eight o'clock on each morning of the Show. *Sweeping Stands, &c.*

81. All Machines requiring steam or fire must be entered as such in the Certificate, and will be placed in the Motion Yard. *Coke only shall be used in all cases where fire is required.* Coal shall not be used at any time in the Showyard. Those infringing this Rule shall incur a penalty of £5. *Fuel.*

82. No Steam Engine shall be driven in the Yard at a greater speed than 4 miles an hour. Traction Engines shall not be used in conveying Exhibits or other goods into, from one place to another in, or out of the Showyard. *Steam Engines.*

83. Locomotive and Traction Engines and other Machines must not be moved from their places without permission of the Secretary or Stewards, and must not leave their stands till 6 P.M. on Friday.

84. There must be attached to each Implement, when forwarded to the Show, a label bearing the Exhibitor's name, and that of the Implement, as well as the number of the Exhibitor's stand. *Consigning Implements.*

85. The carriage of all Implements must be prepaid.

86. Each Exhibitor in the Implement Department will receive one free Ticket of Admission to the Showyard for himself or a member of his firm, and will receive, in addition, for the use of attendants employed by him at his Stand, two Tickets of Admission for each complete ten feet of shedding in the Motion Yard, and one Ticket for each complete ten feet of shedding in the other sections. No additional Free Tickets can be issued in any circumstances whatever. Additional Attendants' Tickets, not more than five for any one Exhibitor, may be purchased at 5s. each. *Exhibitors' and Attendants' Tickets.*

87. The Tickets of Admission for Exhibitors and Attendants referred to in the foregoing Regulation will (about fourteen days prior to the Show) be issued to the Exhibitors in blank, with the number of the Exhibitor's Stand. The name of the person for whom each ticket is intended must be written on it before it is used. Each person holding a Free Ticket of Admission must sign his or her name on the back thereof, and must also, when required, sign his or her name in the book at the Entrance Gate. Exhibitors' attendants are strictly cautioned not to lend or transfer their Tickets, which can be used only by the persons whose names they bear, and who must be *bona fide* acting for, or employed by, the Exhibitor. No Ticket is transferable. An Exhibitor is liable to a fine of £1 for each case of transfer or other improper use of a Ticket issued to himself or employee. *Tickets to be filled up and signed.* *Tickets not Transferable.* *Improper use of Tickets.*

STALL RENT.

88. Ground to be taken in spaces of 10 feet frontage by 20 feet deep, except in Motion Yard, which is to be 10 feet or any larger amount of frontage by 50 feet deep.

89. Rates for space, payable by Exhibitors when making their Entries:—

	Members	Non-Members.
Space without Shedding, 20 feet deep, per 10 feet	£1 5 0	£1 15 0
Shedding, 20 feet deep, 7 feet high to eave, per 10 feet	1 5 0	1 15 0
Shedding, 20 feet deep, 7 feet high to eave, *boarded at back*, per 10 feet	1 12 0	2 2 0
Space in Motion Yard, without Shedding, 50 feet deep, per foot	0 5 0	0 8 0
And with Shedding, 20 feet deep, 10 feet high to eave, per foot	0 7 0	0 10 0
Covered Booths for offices, 9 feet by 9 feet, each	3 10 0	5 0 0
Newspaper offices, each . . £2, 10s.		

ADMISSION OF THE PUBLIC.

The public will be admitted daily at 8 A.M. Judging begins on Tuesday at 10 A.M. The charges for admission to the Yard will be—Tuesday, from 8 A.M. till 5 P.M., 5s. Wednesday, from 8 A.M. till 5 P.M., 3s., and from 5 P.M. till 8 P.M., 1s. Thursday, from 8 A.M. till 5 P.M., 2s., and from 5 P.M. till 8 P.M., 1s. Friday, from 8 A.M. till 5 P.M., 1s.

ADMISSION OF MEMBERS AND EXHIBITORS.

On exhibiting their "*Member's Ticket,*" which is strictly not transferable, Members of the Society are admitted free to the Showyard and to the Enclosures and Stands around the Large Ring, excepting the Reserved Seats in the Grand Stand, and such other parts as may be reserved for any special purpose. Tickets will be sent to all Members residing in the United Kingdom whose addresses are known, and on no account will duplicates be issued. All Members not producing their tickets must pay at the gates, and the admission money will not on any account be returned.

Tickets of admission to the Showyard are sent to Exhibitors of Stock, Poultry, Dairy Produce, and Wool (not Members) whose Entry Fees amount to not less than 10s.

For Exhibitors of Implements and their assistants tickets are issued as provided in the Regulations for Implements.

Tickets for attendants on Stock are not available to admit to the Yard between 11 A.M. and 5 P.M.; and any of these attendants requiring to leave the Yard during the day cannot be again admitted except by a special pass (to be applied for at the Ticket Gate), which must be given up on his return.

RESERVED SEATS IN GRAND STAND.

Reserved Seats in the Grand Stand (numbered).

For Charges, apply to Secretary.

VARIOUS.

Placards, except those of the Society, are prohibited both inside the Showyard and on the outside of the Boundary Fence, with the exception of those belonging to Exhibitors, whose right is confined to their own stalls. No newspapers or any other article allowed to be carried about the Yard for sale or display. No strolling bands or musicians admitted.

No Carriages or Equestrians admitted without special leave from the Directors, and then only for Invalids. Bath-chairs may be brought in.

Premium Lists, Regulations, and Certificates of Entry may be obtained by applying at the Secretary's Office, No. 3 George IV. Bridge, Edinburgh.

All Communications should be addressed to JAMES MACDONALD, Esq., *Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh.*

Address for Telegrams—"SOCIETY," EDINBURGH.

LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Monday, 12th May.

STOCK, POULTRY, AND DAIRY PRODUCE—Monday, 9th June.

No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Monday morning (9th June). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (11th June), at the Society's Office, Edinburgh, at 10 o'clock.

COVERED BOOTHS FOR OFFICES—Monday, 9th June.

RAILWAY ARRANGEMENTS.

The Railway Companies will be furnished with a list of the Exhibitors of Stock and Implements, after the 28th June, and all applications for horse-boxes and trucks, and for information as to arrangements of Special Trains, must be made by the Exhibitors themselves with the Stationmaster where their stock is to be trucked.

The arrangements made by the Railway Companies for the conveyance of Live Stock and Goods to and from the Show are **indicated** *below, but exhibitors are recommended to apply to the respective companies for* **full particulars** :—

1. Live Stock and Goods *to* the Show to be charged ordinary rates.
2. Live Stock and Goods *from* the Show, *if sold*, to be charged ordinary rates.
3. Live Stock and Goods *from* the Show, *if unsold*, to be carried at half rates back to the station whence they were sent, at owners' risk, on production of a certificate from the Exhibitor to the effect that they are really unsold; failing production of such certificate, ordinary rates must be charged. The reduction to half rate is to be allowed only when the animals or goods are returned by the same route as that by which they were conveyed *to* the Show. The minimum charge for Stock returned at half rates will be one-half the ordinary minimum.

If the unsold Live Stock which was carried on the outward journey by Passenger Train in horse-boxes be required to be returned by Goods Train in cattle trucks, half the Goods Train rates must be charged.

If the unsold Live Stock which was carried on the outward journey by Goods Train in cattle trucks be required to be returned by Passenger Train in horse-boxes, half the Passenger Train rates must be charged.

4. Horses and Cattle, when sent for exhibition from one Agricultural Show to another, in another part of the country, are charged the ordinary single rates in respect of each journey, from point to point, up to the last station to which they are sent for exhibition. If remaining unsold when returned from the latest Show to the originating or home station, they are—on production of the necessary certificates—charged half rates, provided such return journey is made by the line of the company by whose route it was conveyed on the outward journey, or, where more than one company is concerned, by the same route as conveyed on the outward journey. If conveyed by Goods Train, Unsold Live Stock transferred from one Agricultural Show to another in another part of the country must be charged ordinary rates.
5. Unsold goods, previously carried by railway, transferred from one Agricultural Show to another, in another part of the country, will be conveyed at half rates at owners' risk, on production of certificate from the Exhibitor to the effect that they are unsold; failing production of such certificate, ordinary rates will be charged.
6. Poultry to be charged ordinary rates both ways, and will not be accepted for conveyance unless the carriage charges are prepaid.
7. Horse-boxes, or other Passenger Train vehicle, will not be provided for the carriage of Live Stock sent by Goods Train and invoiced at Goods Train rates. *For rates for Horse-boxes by Passenger and Special Trains, apply to the Railway Companies.*
8. Provender conveyed to Agricultural Shows with Live Stock will be charged ordinary rates, except so much of the same as may be required on the journey.

9. Men, certified by the owners to be *bona fide* in charge of Live Stock, to be conveyed free in the same train as the animals, as follows: One man for each consignment, except where the consignment requires more than one vehicle, when one man for each vehicle may be sent free; but no pass is given unless the charge for the consignment amounts to as much as the charge for one horse. When two or three horses forming one consignment are sent in the same horse-box, and a man is required to travel with each animal, the men may be conveyed free, provided each horse is charged at the single horse rate. Upon both the outward and homeward journeys a separate certificate and contract must be given, which must be retained by the stationmaster at the outward or homeward starting-point, as the case may be.

10. The ordinary rates charged for carriage do not in any case include delivery *to*, or collection *from*, the Show ground.

11. Agricultural Societies' Show Plant must be charged at Class C rates, station to station.

12. Tents, Canvas, and other articles carried to Shows, not for exhibition, to be charged the ordinary rates both going and returning.

13. The carriage of all Live Stock, Implements, and other articles going to the Show for exhibition must be *prepaid.*

DELIVERY CHARGES.

The following will be the Charges for the Delivery or Collection of Live Stock, Implements, and other articles between the Railway Stations at Inverness and the Show ground:—

1. General traffic, 3s. per ton (minimum charge, 1s. 6d.)
2. Implements and Machinery (Agricultural), not exceeding 1 ton each, 4s. per ton (minimum charge, 2s.)
3. Implements and Machinery (Agricultural), on their own wheels (specially hauled), not exceeding 1 ton, 4s. each.
4. Single articles, exceeding 1 ton, but not exceeding 3 tons, 4s. per ton.
5. Single articles, exceeding 3 tons, but not exceeding 5 tons, 6s. 6d. per ton.
6. Single articles, exceeding 5 tons, by special arrangement only, but no less charge than 8s. 6d. per ton.
7. Rustic Houses, by special arrangement only, but no less charge than 7s. 6d each.
8. Carriages, four-wheeled, 5s. each.
9. Carriages, two-wheeled, 4s. each.
10. Cattle, in floats, 3s. 6d. per head (minimum charge, 5s.)
11. Sheep and Pigs, in floats, 1s. per head (minimum charge, 5s., and maximum charge, 7s. 6d. for each float).

THE PRESIDENT'S CHAMPION MEDALS

A Champion Medal is given by The Earl of Aberdeen, President of the Society, for the *best Animal or pen* in each of the following sections:—

1. Shorthorn.
2. Aberdeen-Angus.
3. Galloway.
4. Highland.
5. Ayrshire.
6. Fat Cattle.
7. Clydesdale Stallions.
8. Draught Geldings.
9. Clydesdale Mares and Fillies.
10. Hunters.
11. Hackneys.
12. Harness Horses.
13. Ponies.
14. Highland Ponies.
15. Shetland Ponies.
16. Blackfaced Sheep.
17. Cheviot.
18. Border Leicester.
19. Shropshire.
20. Half-bred.
21. Oxford Down.
22. Suffolk.
23. Swine.

Note.—*Animals entered as Extra Stock may compete for these Medals. Former Winners of the President's Medals are eligible. The Society shall have the right to photograph the Winners for publication in the 'Transactions.' At this Show no animal can be awarded more than one of these Medals.*

CATTLE

SHORTHORN.

Class		1st. £	2nd. £	3rd. £	4th. £	
1.	Bull calved before 1900	15	10	5	3	
2.	Bull calved in 1900	15	10	5	3	
3.	Bull calved in 1901	12	8	4	2	
	Breeder of best Bull of any age in the three Classes—The Silver Medal.					
4.	Cow of any age	12	8	4	2	
5.	Heifer calved in 1900	10	5	3	2	
6.	Heifer calved in 1901	10	5	3	2	
	[1] Best Bull in the three Classes—£20.					
	President's Medal for best Shorthorn.					
						£158

ABERDEEN-ANGUS.

[2] Two Silver Cups, each of the value of £50, for the best Bull of any age and for the best Cow of any age (Heifers excluded) in the Aberdeen-Angus cattle classes. These are to be Challenge Cups, and are to be known as the "Ballindalloch Challenge Cups." They are offered under the following conditions: 1. The Directors shall assume charge of the Cups, and shall frame such rules for their safety as they may decide upon. 2. Each Cup shall be held by the winner for one year as a Challenge Cup, and shall become the property of the exhibitor who shall win it five times, not necessarily in succession. 3. The Society shall, at their own expense, cause to be engraved on each Cup each year, the year, the place of the Show, name of successful exhibitor, name and herd-book number of the animal, and name of its breeder. 4. The Society shall award to the breeder of the successful animals a Silver Medal, bearing that he is the breeder of the winner of the "Ballindalloch Challenge Cup." 5. In every other respect the Cups shall be won according to regulations which the Directors may from time to time enact.

7.	Bull calved before 1st Dec. 1899	15	10	5	3	
8.	Bull calved on or after 1st Dec. 1899	15	10	5	3	
9.	Bull calved on or after 1st Dec. 1900	12	8	4	2	
	[3] Champion Cup, value £50, for the best Bull in the three Classes.					
	[4] Champion Gold Medal for best Bull of the breed in the Showyard.					
	Breeder of best Bull of any age in the three Classes—The Silver Medal.					
						92
					Carry forward	£250

[1] Given by the Shorthorn Society.
[2] The Cup for Bulls given by Sir George Macpherson Grant, Bart., and that for Cows by the late Mr C. Macpherson Grant of Drumduan.
[3] Given by Sir George Macpherson Grant, Bart.
[4] Given by the Polled Cattle Society.

Brought forward £250

ABERDEEN-ANGUS—*continued.*

Class		Premiums. 1st. £	2nd. £	3rd. £	4th. £	
10	Cow of any age . . .	12	8	4	2	
	[1] Champion Cup, value £50, for the best Cow of any age in the above Class.					
11.	Heifer calved on or after 1st Dec. 1899	10	5	3	2	
12.	Heifer calved on or after 1st Dec. 1900	10	5	3	2	
	[2] Champion Gold Medal for best Female breeding animal of the breed in the Showyard.					
	President's Medal for best Aberdeen-Angus Animal.					66

GALLOWAY.

13.	Bull calved before 1st Dec. 1899 .	15	10	5	3	
14.	Bull calved on or after 1st Dec. 1899 .	15	10	5	3	
15.	Bull calved on or after 1st Dec. 1900 .	12	8	4	2	
	Breeder of best Bull of any age in the three Classes—The Silver Medal.					
16.	Cow of any age . . .	12	8	4	2	
17.	Heifer calved on or after 1st Dec. 1899	10	5	3	2	
18.	Heifer calved on or after 1st Dec. 1900	10	5	3	2	
	President's Medal for best Galloway.					158

HIGHLAND.

19.	Bull calved before 1900 . .	15	10	5	3	
20	Bull calved in 1900 . . .	15	10	5	3	
21.	Bull calved in 1901 . . .	12	8	4	2	
	Breeder of best Bull of any age in the three Classes—The Silver Medal.					
22.	Cow of any age, in Milk, or with Calf at foot	12	8	4	2	
23.	Heifer calved in 1899 . .	10	5	3	2	
24.	Heifer calved in 1900 . .	10	5	3	2	
	President's Medal for best Highland Animal.					158

AYRSHIRE.

25.	Bull calved before 1900 . .	12	8	4		
26.	Bull calved in 1900 . . .	12	8	4		
27.	Bull calved in 1901 . . .	8	5	3		
	Breeder of best Bull of any age in the three Classes—The Silver Medal.					
28.	Cow calved before 1899 in Milk .	10	7	3		84

Carry forward £716

[1] Given by the late Mr C. Macpherson Grant of Drumduan.
[2] Given by the Polled Cattle Society.

	Brought forward				£716
		Premiums.			
	AYRSHIRE—*continued.*	1st.	2nd.	3rd.	
Class		£	£	£	
29.	Cow in Milk, calved after 1st Jan. 1899	10	7	3	
30.	Cow of any age in Calf, or Heifer calved in 1899 in Calf and due to calve within nine months after the Show	10	7	3	
31.	Heifer calved in 1900 . .	10	5	3	
32.	Heifer calved in 1901 . .	8	5	3	
	President's Medal for best Ayrshire.				74
	FAT CATTLE.				
33.	Ox, any pure-bred or cross, calved after 1st Dec. 1899 . .	5	2	—	
34.	Ox, any pure-bred or cross, calved after 1st Dec. 1900 . .	5	2	—	
35.	Heifer, any pure-bred or cross, calved after 1st Dec. 1899 . . .	5	2	—	
36.	Heifer, any pure-bred or cross, calved after 1st Dec. 1900 . . .	5	2	—	
	President's Medal for best fat animal.				28
					£818

HORSES

FOR AGRICULTURAL PURPOSES.

		Premiums.				
	DRAUGHT STALLIONS.	1st.	2nd.	3rd.	4th.	
		£	£	£	£	
37.	Stallion foaled before 1899 . .	20	15	10	4	
38.	Entire Colt foaled in 1899 . .	20	15	10	4	
39.	Entire Colt foaled in 1900 . .	20	12	8	4	
40.	Entire Colt foaled in 1901 . .	15	10	6	4	
	Breeder of best Male Animal of any age in the four Classes—The Silver Medal.					£177
	President's Medal for best Clydesdale Stallion.					
	DRAUGHT GELDINGS.					
41.	Draught Gelding foaled before 1899	10	5	3	—	
42.	Draught Gelding foaled in 1899 .	6	4	3	—	
43.	Draught Gelding foaled in 1900 .	6	4	3	—	
						44
	President's Medal for best Draught Gelding.					
			Carry forward			£221

No animal is allowed to compete in more than one Class, except that horses entered in other Classes may also compete in the Jumping and Driving Classes.

Brought forward £221

Class DRAUGHT MARES AND FILLIES.	Premiums. 1st. £	2nd. £	3rd. £	4th. £	
44. Mare of any age, with Foal at foot	20	12	7	4	
45. Yeld Mare foaled before 1899	12	9	6	4	
46. Yeld Mare or Filly foaled in 1899	12	9	6	4	
47. Filly foaled in 1900	12	9	6	4	
48. Filly foaled in 1901	12	9	6	4	
					167

Best Clydesdale Mare or Filly—Cawdor Challenge Cup, value 50 guineas. See Conditions below.

CONDITIONS OF COMPETITION FOR THE THIRD CAWDOR CHALLENGE CUP FOR MARES. (VALUE 50 GUINEAS.)

1. This Cup is offered by the Clydesdale Horse Society of Great Britain and Ireland for the best Clydesdale Mare or Filly registered in the Clydesdale Stud-book, entered in any of the Draught Horse classes, at the Show at which it may be competed for.

2. The Council of the Clydesdale Horse Society shall, at a meeting held not later than the month of August in any year, decide at what Show or Shows the "Cawdor Challenge Cups" shall be competed for in the year immediately following.

3. This Cup must be won three times by an Exhibitor with different animals (but not necessarily in consecutive years) before it becomes his absolute property; and immediately after an award has been made, and official notification thereof has been received by the Secretary of the Clydesdale Horse Society from the Secretary of the Society under whose auspices the Competition has taken place, the name of the winner, and of the animal with which the Cup has been won, will be engraven on the Cup.

4. The winner of the Cawdor Challenge Cup, other than the absolute winner, shall, before delivery thereof is made to him, give security to the Clydesdale Horse Society that he shall surrender the same to the Society and deliver it at the Society's office when called upon to do so.

5. Until the Cup be won outright, the winner of the Cawdor Challenge Cup will receive the Clydesdale Horse Society's Silver Medal as a memento of his winning the Cup; and the said Medal shall bear an inscription specifying the Show at which, the date on which, and the name of the animal with which the Challenge Cup has been won, as well as the name of the owner.

In name of the Council of the Clydesdale Horse Society,

ARCHD. MACNEILAGE, *Secretary.*

[1] Breeder of Best Clydesdale Brood Mare—The Robert Murdoch Prize, value £10.

President's Medal for best Clydesdale Mare or Filly.

Carry forward £388

[1] Bequest by the late Miss Murdoch.

Brought forward £388

HUNTERS.

Class		Premiums. 1st. £	2nd. £	3d. £	
49.	Colt, Gelding, or Filly, foaled in 1901, the produce of thorough-bred Stallions, out of Mares of any breed,—Five Prizes [1]—£10, £7, £5, £2, £1.				
50.	Filly, Mare, or Gelding, for field, foaled in 1900—*in hand* .	8	5	3	
51.	Yeld Mare, Filly, or Gelding for field, foaled in 1899—*in hand* .	8	5	3	
[2]	Best Hunter Filly in Classes 49, 50, and 51—Gold Medal, value £10, 10s.				
52.	[3]Hunter Brood Mare, with foal at foot or to foal this season—£15, £8, £4.				32

President's Medal for best Hunter.

HACKNEYS.

(All to be shown in hand.)

53.	Brood Mare, 15 hands and upwards, with Foal at foot, or to foal this season to a registered Sire .	10	6	4	
54.	Brood Mare, under 15 hands, with Foal at foot, or to foal this season to a registered Sire . .	10	6	4	
55.	Yeld Mare or Filly, foaled in 1899	8	5	3	
56.	Filly, foaled in 1900 . .	8	5	3	
57.	Filly, foaled in 1901 . .	8	5	3	
58.	Stallion, foaled in or before 1899, over 15 hands . . .	10	6	4	
59.	Stallion, foaled in or before 1899, over 14 and not over 15 hands	10	6	4	
60.	Entire Colt, foaled in 1900	8	5	3	
61.	Entire Colt, foaled in 1901. .	8	5	3	
					160

Carry forward £580

[1] Given by Sir John Gilmour of Montrave, Bart.
[2] Given by the Hunter Improvement Society.
[3] Given by Captain Clayhills Henderson of Invergowrie, R.N.

Brought forward £580

All animals entered in the above Hackney Classes must be registered in the Hackney Stud-book except in Classes 57 and 61, and animals entered in Classes 57 and 61 must be eligible for entry in the Hackney Stud-book.

[1] Gold Medal, value £10, by Hackney Horse Society for best Mare or Filly in Hackney or Pony Classes.

President's Medal for best Hackney.

PONIES.

Class	Premiums. 1st. £	2nd. £	3rd. £
62. Stallion, 3 years old and upwards, over 12, not exceeding 14 hands—*in hand* . . .	5	3	2
63. Yeld Mare, Filly, or Gelding, 3 years old and upwards, over 13 and not over 14½ hands—*in saddle*	5	3	2
64. Yeld Mare, Filly, or Gelding, 3 years old and upwards, over 12 and not over 13 hands—*in saddle*	5	3	2
65. Stallion, 3 years old and upwards, 12 hands and under—*in hand* .	5	3	2
66 Yeld Mare, Filly, or Gelding, 3 years old and upwards, 12 hands and under—*in saddle* . .	5	3	2

President's Medal for best Pony.

50

Carry forward £630

HIGHLAND PONIES.

67. [2] Pony Stallion, not exceeding 14.2 hands, best adapted to get ponies, out of Highland Pony Mares, suitable for Mounted Infantry—Prize of £20.

It is provided that the Stallion which wins this Prize shall serve Highland Pony Mares in 1903—to the number of forty, if required—in such of the Northern counties, and at such centres as may be hereafter arranged by the Society, at the following fees—viz.: 1 guinea per mare, with a further fee of one guinea per foal.

[1] A Mare 6 years old or more must have had a living foal. Winners of the Hackney Society's Gold Medals in 1902, except at the London and Royal English Shows, excluded. The winner must be entered or accepted for entry in Hackney Stud-book, and certified free from hereditary disease. The Gold Medal being of the intrinsic value of £10, that amount will be paid by the Hackney Horse Society at any time if the Medal be returned in good condition.

[2] Given by Lord Tweedmouth.

Class		Premiums. 1st.	2nd.	3rd.	
	Brought forward				£630
	HIGHLAND PONIES—*continued.*	£	£	£	
68.	[1] Highland Pony Stallion, 3 years old or upwards, not exceeding 14.2 hands, entered or accepted for entry in the Highland Section of the Polo Pony Stud-Book .	5	3	2	
	[2] Special Prize of £5, 5s. for best Stallion in Class 68.				
69.	Highland Pony Mare, 3 years old or upwards, not exceeding 14.2 hands, yeld or with foal at foot, entered or accepted for entry in the Highland Section of the Polo Pony Stud-Book	5	3	2	
	[2] Special Prize of £5, 5s. for best Mare in Class 69.				20
	President's Medal for best Highland Pony.				
	SHETLAND PONIES. (*All to be shown in hand.*)				
70.	Stallion, not exceeding 10½ hands, foaled before 1899 . .	5	3	2	
71.	Entire Colt, not exceeding 10½ hands, foaled in 1899 or 1900 . .	5	3	2	
72.	Mare, not exceeding 10½ hands, with foal at foot	5	3	2	
73.	Yeld Mare, not exceeding 10½ hands	5	3	2	
74.	Filly, not exceeding 10½ hands, foaled in 1899 or 1900 .	5	3	2	
	[3] Special Prize of £10 for best Shetland Pony in the foregoing Classes.				50
	President's Medal for best Shetland Pony.				
	DRIVING COMPETITIONS.				
75.	Yeld Mare, Filly, or Gelding, in Harness, 15 hands and upwards, to be driven in the ring . .	10	5	3	
76.	Yeld Mare, Filly, or Gelding, in Harness, under 15 hands, to be driven in the ring . . .	10	5	3	
					36
	President's Medal for best animal in the Classes for Horses in Harness.[4]				£736

[1] Exhibitors desirous of entering in these Classes Ponies not yet accepted for entry in the Highland Section of the Polo Pony Stud-Book are recommended to communicate with Mr J. H. Munro Mackenzie of Calgary, Isle of Mull, who will advise as to the steps to be taken with a view to the registration of the Ponies. All entries for above Classes must be accompanied by a certificate, either from Mr Mackenzie or from Mr A. B. Charlton, Secretary to the Polo Pony Society, 12 Hanover Square, London, W., to the effect that the animals are entered or accepted for entry in the Highland Pony Section of the Polo Pony Stud-Book.

[2] Given by the Polo Pony Society. [3] Given by Lady Estella Hope.

[4] ***An animal that has won a President's Medal in another section in this Show shall not be eligible to compete for the Medal in this section.***

JUMPING COMPETITIONS

SPECIAL REGULATIONS.

(*See also the Regulations on pages* 53 *to* 64.)

1. Jumping Competitions will take place on the afternoons of Wednesday, Thursday, and Friday, the 16th, 17th, and 18th July.
2. *Entries* for each day's Competitions will close at the Secretary's Office in the Showyard at 6 P.M. on the preceding day.
3. *Entry Fees.*—Wednesday, £1; Thursday and Friday, 10s. for each class.
4. *Accommodation* for jumping horses will be provided as follows: Covered shed in which to stand during the day free of charge; or, on application to the Secretary not less than seven days before the opening of the Show, stalls or loose-boxes will be provided at a charge (in addition to the Entry Fee) of £1 for a stall, and £1, 10s. for a loose-box, which must be paid along with the Entry Fee at the time of application.
5. Horses entered for jumping only need not enter the Showyard till 12 noon on the day of Competition, and may leave the Showyard at 6 P.M. each day.
6. *The Jumps* may consist of Single Hurdle, Gate, Double Hurdle, Wall, and Water Jump, power being reserved by the Society to alter these, as well as the Handicaps, as may be thought desirable.

Class	1st. £	2nd. £	3rd. £	4th £	5th £	
WEDNESDAY.						
1. Horses or Ponies any height . .	20	15	10	5	3	
THURSDAY.						
2. Horses or Ponies any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in Class 1	10	8	5	3	2	
FRIDAY.						
3. Horses or Ponies any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in either of Classes 1 or 2—4 inches extra for the winner of the two first prizes in Classes 1 and 2 . .	10	8	5	3	2	
Champion Prize for most points in Prizes with one or more horses in above Classes —First Prize to count five points; Second Prize, four points; Third Prize, three points; Fourth Prize, two points; and Fifth Prize, one point—the money to be evenly divided in the event of a tie .	10	—	—	—	—	
						£119

SHEEP

	Premiums. 1st.	2nd.	3rd.	4th.	
BLACKFACED.					
Class	£	£	£	£	
77. Tup above one shear	12	8	4	2	
78. Shearling Tup	12	8	4	2	
79. Ewe above one shear, with her Lamb at foot	10	5	2	—	
80. Shearling Ewe or Gimmer	10	5	2	—	
					£86

[1] Special Prize of £10 for the five best Blackfaced Shearling Rams in class 77, bred by Exhibitor, and never away from or out of his possession.

[1] For Blackfaced Shearling Ram in class 77 best adapted for producing stock to yield early mutton irrespective of wool value—the ram to be bred by Exhibitor, and never away from or out of his possession—1st Prize, £8; 2nd, £4; 3rd, £2.

President's Medal for best pen of Blackfaced Sheep.

CHEVIOT.					
81. Tup above one shear	12	8	4	2	
82. Shearling Tup	12	8	4	2	
83. Ewe above one shear, with her Lamb at foot	10	5	2	—	
84. Shearling Ewe or Gimmer	10	5	2	—	
					86

President's Medal for best pen of Cheviot Sheep.

BORDER LEICESTER.

Tweeddale Gold Medal for best Tup—£20.

85. Tup above one shear	12	8	4	2	
86. Shearling Tup	12	8	4	2	
87. Ewe above one shear	10	5	2	—	
88. Shearling Ewe or Gimmer	10	5	2	—	
					86

President's Medal for best pen of Border Leicesters.

HALF-BRED.					
89. Tup above one shear	12	8	4	2	
90. Shearling Tup	12	8	4	2	
91. Ewe above one shear	10	5	2	—	
92. Shearling Ewe or Gimmer	10	5	2	—	
					86

President's Medal for best pen of Half-Breds.

Carry forward £344

[1] Given by Mr Charles Howatson of Glenbuck

	Brought forward				£344
		Premiums.			
	SHROPSHIRE.	1st.	2nd.	3rd.	
Class		£	£	£	
93.	Tup above one shear . .	6	4	2	
94.	Shearling Tup . . .	6	4	2	
95.	Ewe above one shear . .	5	3	2	
96.	Shearling Ewe or Gimmer . .	5	3	2	
					44
	President's Medal for best pen of Shropshires.				
	OXFORD-DOWNS.				
97.	Shearling Tup . . .	6	4	2	
98.	Shearling Ewe or Gimmer . .	5	3	2	
					22
	President's Medal for best pen of Oxford-Downs.				
	SUFFOLK.				
99.	Shearling Tup . . .	6	4	2	
100.	Shearling Ewe or Gimmer . .	5	3	2	
101.	[1] Three Ewe Lambs, £5, £3, and £2.				22
	President's Medal for best pen of Suffolk Sheep.				
	EXTRA SECTIONS.				
102	Five Fat Lambs, any breed or cross, dropped in the year of the Show	5	3	—	
					8
					£440

[1] Best pen of Lambs in Class 102 got by a Suffolk Tup, and out of Cheviot or Blackfaced Ewes—£5.

[1] Best pen of Lambs in Class 102 got by a Suffolk Tup, and out of Border Leicester, Half-bred, or Three-parts-bred Ewes—£5.

[2] Best pens of Cross-bred Lambs in Class 102 got by an Oxford-Down Tup—£5, £3, and £2.

[3] Best pens of Cross-bred Lambs in Class 102 got by a Shropshire Tup—£5, £3, £2.

WOOL.

103. [4] Blackface Wether Wool, five fleeces—£3, £2, £1.
104. [4] Blackface Ewe Wool, five fleeces—£3, £2, £1.
105. [4] Blackface Ewe or Wether Hogg Wool, five fleeces—£3, £2, £1.

Note.—All fleeces must be white, unwashed, and shorn in the year of the Show from sheep bred and reared on, or regular stock of, the Exhibitor's farm.

[1] Given by the Suffolk Sheep Society.
[2] Given by Oxford-Down Sheep-Breeders' Association.
[3] Given by Breeders of Shropshire Sheep, per Mr D. Buttar.
[4] Given by Sir Robert Menzies, Bart.

SWINE

Class	LARGE WHITE BREED.	Premiums. 1st. £	2nd. £	
106.	Boar	5	3	
107.	Sow	5	3	
108.	Three Pigs, not above 8 months old	4	2	
				£22
	WHITE BREED OTHER THAN LARGE.			
109.	Boar	5	3	
110.	Sow	5	3	
111.	Three Pigs, not above 8 months old	4	2	
				22
	BERKSHIRE.			
112.	Boar	5	3	
113.	Sow	5	3	
114.	Three Pigs, not above 8 months old	4	2	
	President's Medal for best pen of Swine.			22
				£66

EXTRA STOCK

Animals not included in the Classes for Competition may be exhibited as Extra Stock, and may receive Awards as follows:—Very Highly Commended, or Highly Commended, carrying the Medium Silver Medal, or Commended, for which the Bronze Medal is given.

Animals entered as Extra Stock are eligible to compete for the President's Medals, whether former winners of these Medals or not.

POULTRY

First Premium—ONE SOVEREIGN; *Second Premium*—TEN SHILLINGS. In each Class in which there are six or more entries, a Third Prize of Five Shillings may be awarded, provided there is sufficient merit in the pens. Three or more Commendations may also be given—thus, Very Highly Commended, Highly Commended, and Commended.

Champion Medals are offered as follows:—

1. Best Cock, any Variety.
2. Best Hen, any Variety.
3. Best Cockerel, any Variety.
4. Best Pullet, any Variety.
5. Best Pen of Ducks.
6. Best Pen of Geese.
7. Best Pen of Turkeys.

Aged Birds must have been hatched previous to, and Cockerels and Pullets in, the year of the Show.

DORKING—	Class		Class
Coloured	1. Cock	COCHIN-CHINA	9. Cock
	2. Hen		10. Hen
	3. Cockerel	BRAHMAPOOTRA	11. Cock
	4. Pullet		12. Hen
Silver Grey	5. Cock	BRAHMA or COCHIN	13. Cockerel
	6. Hen		14. Pullet
	7. Cockerel	SCOTCH GREY	15. Cock
	8. Pullet		16. Hen

	Class	
Scotch Grey . .	17.	Cockerel
	18.	Pullet
Hamburg—		
Black . . .	19.	Cock
	20.	Hen
Any other Variety .	21.	Cock
	22.	Hen
Any Variety . .	23.	Cockerel
	24.	Pullet
Plymouth Rock .	25.	Cock
	26.	Hen
	27.	Cockerel
	28.	Pullet
Minorca . .	29.	Cock
	30.	Hen
	31.	Cockerel
	32.	Pullet
Leghorn—		
White . . .	33.	Cock
	34.	Hen
Any other Variety .	35.	Cock
	36.	Hen
Any Variety . .	37.	Cockerel
	38.	Pullet
Langshan . . .	39.	Cock
	40.	Hen
Orpington . . .	41.	Cock
	42.	Hen
Langshan or Orpington	43.	Cockerel
	44.	Pullet
Wyandotte—		
Gold or Silver . .	45.	Cock
	46.	Hen
Any other Variety .	47.	Cock
	48.	Hen
Any Variety . .	49.	Cockerel
	50.	Pullet
Game—		
Old English . .	51.	Cock
	52.	Hen
Indian . . .	53.	Cock
	54.	Hen
Modern . . .	55.	Cock
	56.	Hen

	Class	
Game— *Any Variety, including Old English and Indian* . . .	57.	Cockerel
	58.	Pullet
Bantam— *Game, any Variety, including Old English and Indian* . .	59.	Cock
	60.	Hen
Any other Variety Bantam . .	61.	Cock
	62.	Hen
Any other recognised Breed of Poultry .	63.	Cock
	64.	Hen
	65.	Cockerel
	66.	Pullet
Table Fowls— *Any Breed or Cross, to be judged solely as Table Fowls, and without regard to fancy points* .	67.	Pair of Cockerels
	68.	Pair of Pullets
Ducks— *Aylesbury* . . .	69.	Drake
	70.	Duck
	71.	Drake (Young)
	72.	Duck (Young)
Rouen . . .	73.	Drake
	74.	Duck
Any other Variety .	75.	Drake
	76.	Duck
Any Breed (Aylesbury excepted) .	77.	Drake (Young)
	78.	Duck (Young)
Geese	79.	Gander
	80.	Goose
Turkeys . . .	81.	Cock
	82.	Hen

Amount of Poultry Premiums, £140.

DAIRY PRODUCE

No Exhibitor to show more than one lot in any Class.

Class	Premiums. 1st. £	2nd. £	3rd. £	4th. £
1. Cured Butter, not less than 7 lb. . .	4	2	1	—
2. Powdered Butter, not less than 7 lb. . .	4	2	1	—
3. Fresh Butter, three 1-lb. rolls . .	4	2	1	—
4. Cheddar Cheese, 56 lb. and upwards .	6	4	2	1
5. Cheddar Cheese, 14 lb. and under . .	3	2	1	—
				£40

ABSTRACT OF PREMIUMS.

(23 Champion Medals given by THE EARL OF ABERDEEN.)

GIVEN BY THE SOCIETY.

1. Cattle	£818	0	0
2. Horses	736	0	0
3. Jumping	119	0	0
4. Sheep	440	0	0
5. Swine	66	0	0
6. Poultry	140	0	0
7. Dairy Produce	40	0	0
8. Medals to Breeders, &c.	20	0	0
	£2379	0	0

CONTRIBUTED PRIZES.

1. The Shorthorn Society	£20	0	0			
2. Sir George Macpherson Grant, Bart.	50	0	0			
3. The late Mr C. Macpherson Grant of Drumduan	50	0	0			
4. Polled Cattle Society	20	0	0			
5. Cawdor Challenge Cup	52	10	0			
6. Bequest by late Miss Murdoch	10	0	0			
7. Sir John Gilmour, Bart.	25	0	0			
8. Captain Clayhills Henderson	27	0	0			
9. Hunters' Improvement Society	10	10	0			
10. Hackney Horse Society	10	0	0			
11. Lord Tweedmouth	20	0	0			
12. Polo Pony Society	10	10	0			
13. Lady Estella Hope	10	0	0			
14. Mr Howatson of Glenbuck	24	0	0			
15. Oxford-Down Sheep-Breeders' Association	10	0	0			
16. Suffolk Sheep Society	20	0	0			
17. Breeders of Shropshire Sheep	10	0	0			
18. Sir Robert Menzies, Bart.	18	0	0			
19. Tweeddale Gold Medal	20	0	0			
				417	10	0
				£2796	10	0

JAMES MACDONALD, *Secretary.*

3 GEORGE IV. BRIDGE,
EDINBURGH, *February* 1902.

The Society's Show for 1903 will be held at Dumfries on the 21st, 22nd, 23rd, and 24th July.

MEMBERS ADMITTED SINCE THE LIST WAS PUBLISHED IN FEBRUARY 1901.

ARRANGED ACCORDING TO SHOW DISTRICTS.

Elected June 5, 1901, and January 8, 1902.

1.—GLASGOW DISTRICT.

ARGYLL.

Admitted
1901 Gardner, John Neilson, Dail-an-Rois, Corpach
1901 Gower, Cecil Leveson, Java Lodge, Craignure, Isle of Mull
1901 Graham, Alex., Tonrioch, Campbeltown

AYR.

1901 Drummond, R. J., West of Scotland Agricultural College, Kilmarnock
1901 Gairdner, Wm. Cecil, Union Bank House, Kilmarnock
1902 Hay, John, Dollars Estate Office, Kilmarnock
1902 Kennedy, Norman, Doonholm, Ayr
1901 Maxwell, Alex., Warrix, Irvine
1901 Robertson, Alex B., The Dean, Kilmarnock
1901 Tivendale, James, Lanfine, Newmilns

BUTE.

1902 Sweet, J. B., Bank of Scotland, Lamlash

LANARK.

1902 Ballingall, Peter Lumsdaine, Hamilton Estates Office, Hamilton
1901 Hope, Thos., South Brownhill, Strathaven
1902 Lawson, Quintin H., 37 West George Street, Glasgow
1901 Maclachlan, John, 27 St Enoch Square, Glasgow

2.—PERTH DISTRICT.

FIFE.

1902 Abbie, Robt., Anfield Farm, Largo, Fife
1901 Cairns, James, South Quarter, Kingsbarns
1902 Collier, John, Blairenbothie Farm, Kelty
1901 Dand, John R., Balwearie, Kirkcaldy
1902 Dewar, James, of Lassodie and Blairathie, Lassodie
1902 Morrison, C. E., Bonnyton, Stravithie, R.S.O.
1901 Morrison, James, Scotstarvit, Cupar-Fife
1902 Sivewright, Sir James, Tullyallan Castle, Kincardine-on-Forth
1902 Thomson, George, Rankeillour, Springfield, Fife

FORFAR.

(Western Division.)

1901 Airlie, Earl of, Cortachy Castle, Kirriemuir
1902 Warden, James L., Easter Meathie, Forfar

KINROSS.

1901 Eley, Henry, of Shire-end, Milnathort
1902 Falconer, William K., Solicitor, Kinross

PERTH.

(Eastern Division.)

1902 Ballingall, Simpson, Parkfield, Scone, Perth
1902 Barnett, William, Wester Ballindean, Inchture
1902 Bett, James Esson, Easterton, Glenfarg
1901 Campbell, J. Douglas, Abernyte House, Inchture
1901 Carmichael, James S., yr. of Arthurstone, Meigle
1901 Davidson, Thos., Balnadrum, Pitlochry
1901 Marshall, David, Joint County Clerk, Perth
1901 Pearson, James C., Auchlatt, Pitlochry
1901 Watson, William, Inchcoonans, Errol

3.—STIRLING DISTRICT.

CLACKMANNAN.

1901 Wight, Walter J., Dollarbank, Dollar

DUMBARTON.

1901 Stuart, Captain John, Inverarnan, Ardlui

PERTH.

(Western Division.)

1901 Campbell, Col. Alex., yr of Kilbryde, Dunblane (address c/o Messrs Barty, Dunblane)

1902 Wilson, John Currie, Tullyallan Estate, Kincardine-on-Forth

STIRLING.

1901 Aitkenhead, Walter, Meadowbank, Polmont

1901 Gray, John (Gray & Co., Grain Merchants), Stirling

1901 M'Adam, William, Kepculloch, Balfron

1901 Miller, J Neilson, Chalmers Manse, Bridge of Allan

4.—EDINBURGH DISTRICT.

EDINBURGH.

1901 Bathgate, William Thomson, Middleton Lime Works, Gorebridge

1902 Dunstan, Professor John, Royal (Dick) Veterinary College, 8 Clyde Street

1902 Fisher, Peter, 2 Cumin Place

1901 Green, Chas Edward, The Hollies, Gordon Terrace, Craigmillar Park

1902 Johnston, Andrew, 28 Garscube Terrace

1902 Knoblauch, Louis, Agra Lodge, Bonnington, Edinburgh

1902 Nelson, Thos Arthur (of Achnacloich), St Leonard's, Edinburgh

1901 Smith, Robert, Cranston Riddell, Dalkeith

1902 Tillie, John, Hangingshaw, Heriot

5.—ABERDEEN DISTRICT.

ABERDEEN.

1901 Alexander, George, Wrae, Turriff

1902 Anderson, George Alexander, Cominsty, Forgue, Huntly

1901 Allan, James R, Ashgrove Engineering Works, Aberdeen

1901 Allan, Richard S., Ashgrove Engineering Works, Aberdeen

1902 Armstrong, John, Whitehills, Cairnie, Huntly

1901 Berry, Peter, Guise, Whitehouse, Aberdeenshire

1901 Bruce, Robert, Heatherwick, Inverurie

1902 Bull, Arthur G, Scottish Live Stock Insurance Co, 215 Union Street, Aberdeen

1901 Burr, J. M., Strichen Estate Office, Strichen

1901 Callander, William, Jericho, Insch, Aberdeenshire

1901 Campbell, George, Harthill, Whitehouse, Aberdeenshire

1901 Cheyne, John, 245 Union Street, Aberdeen

1901 Cook, James M, Waterside of Forbes, Alford, N.B

1902 Cruickshank, George Leslie, Fyvie

1902 Dunbar, John C. F., 3 Golden Square, Aberdeen

1901 Duncan, John William, 477 King Street, Aberdeen

1901 Elmslie, William, Mains of Tonley, Alford. N.B.

1901 Farquharson, W. S., of Whitehouse, Aberdeen

1902 Finch, Cuthbert W., Wellhouse, Alford, N.B.

1901 Forbes, Harry, Greystone, Tullynessle, Alford, N.B.

1902 Glen, William, Lunderton, Peterhead

1901 Hendry, William C., 154 Union Street, Aberdeen

1901 Howie, George, M.R.C.V.S., Alford, N.B.

1901 Ironside, George Letheuty, Alford, N B

1901 Mortimer, William, Old Keig, Whitehouse, Aberdeenshire

1901 Paterson, James, Newbigging, Whitehouse, Aberdeen

1901 Petrie, Charles, Earlsfield, Kennethmont

1901 Rennie, Joseph, Forester, Castle Newe, Strathdon

1901 Robertson, William, Bents, Alford, N.B.

1902 Smith, Andrew, Invercauld Estate Office, Ballater

1901 Walker, John, Westside of Brux, Kildrummy, Mossat

1901 White, Montford Adie, c/o Mr Durno, Westerton, Warthill

1902 Wisely, Wm, 31 Virginia St, Aberdeen

1901 Young, George, Greenhall, Insch, Aberdeenshire

BANFF.

1902 MacConachie, F. G., Ardoch, Deskford, Cullen

1901 M'Conachie, George, Cairnfield, Buckie

1901 Moir, James, Drummuir, Keith

1902 Pirie, George, Bank Agent, Portsoy

1901 Smith, Gordon, Cragganmore, Craigellachie

1901 Smith, George, Greenlaw, Alvah, Banff

FORFAR.

(Eastern Division.)

1902 Howie, Thomas, Beechwood, Arbroath

KINCARDINE.

1901 Wood, Charles, Estates Office, Fettercairn

6.—DUMFRIES DISTRICT.

KIRKCUDBRIGHT.

1901 Carr, Maurice J., Estate Office, Balmaghie, Castle-Douglas
1902 Perman, Fred. Wm., of Drumstinchell, Southwick, Dumfries
1902 Saunders, A. W., Dromore, Kirkcudbright
1901 Wyllie, James, Pleasance of Cargen, Dumfries

7.—INVERNESS DISTRICT.

CAITHNESS.

1901 Anderson, William S., of Lochend, Barrock, Thurso
1901 Barnetson, Benjamin, Milton, Wick
1901 Budge, James, Barnyards, Wick
1901 Clyne, Alex., of Tister, Bower, Caithness
1901 Davidson, Charles, Coggle, Watten, Caithness
1901 Davidson, Jas., West Watten, Caithness
1901 Dunnet, Alex., Halliclay, Thurso
1901 Dunnet, George, Greenland, Castletown, Caithness
1901 Innes, C. B., Thrumster, Wick
1901 Keith, Peter, Thurso
1901 Keith, Wm., West Canisbay, Castleton, Caithness
1901 M'Ivor, John, Borrowston, Reay, Caithness
1901 Mill, Peter, Achscrabster, Thurso
1901 Morrison, Tom, Achvarsdale, Reay, Thurso
1901 Nicholson, Alex., East Murkle, Thurso
1901 Sinclair, Donald, Stemster, Westfield, Thurso
1901 Swanson, William, Mill Farm, Castletown, Caithness
1901 Younger, Alex. Hay, Olrig, Thurso

ELGIN.

1901 Adam, Alex., Kinneddar, Lossiemouth
1901 Austin, Alex , Grand Hotel, Elgin
1901 Butler, Patrick, Hillhead, Forres
1901 Calder, Charles C., Assistant Factor, Earlsmill, Forres
1901 Dawson, George, Kintrae, Elgin
1901 Dawson, James C., Batchen Street, Elgin
1901 Dunbar, Rev. John Arch., of Kinloss and Sea Park, Forres
1901 Findlay, John F , Trochelhill, Fochabers
1901 Forsyth, Robert, Claydales, Alves, Forres
1901 Fraser, Donald, Hempriggs, Alves, Forres
1901 Grant-Peterkin, Montagu James, of Grange, Forres
1901 Macdonald, Alex., Downduff, Dunphail
1901 Macdonald, J., Glenferness, Dunphail
1901 M'Garva, Gilbert R., Innes Estate Office, Urquhart, Elgin
1901 Mackenzie, W. J., Stank House, Elgin
1902 M'Laren, William, Altyre, Forres
1901 Mann, John, Cairnglass, Dunphail
1901 Mavor, John, Lochiehill, Forres
1901 Mavor, Richard, Wellhill, Forres
1901 Murdoch, John, Lynemore, Dunphail
1901 Murray, William, Northern Auction Mart, Elgin
1901 Mutch, Alex. C., Keam, Duffus, Elgin
1901 Pearson, And., Burnside, Duffus, Elgin
1901 Ramsay, William, of Longmorn, Elgin
1901 Reid, George, Rothills, Duffus, Elgin
1901 Simpson, John, Styne, Fochabers
1901 Smith, J. Grant, Seafield Estates Office, Elgin
1901 Wiseman, Edward, Nurseryman and Seedman, Elgin

INVERNESS.

1901 Allan, John M., Easter Duthil, Carr Bridge
1901 Allison, Thomas, Solicitor, Fort-William
1901 Anderson, Alex., 49 Eastgate, Inverness
1901 Bain, A. T. N., 4 Falcon Sq., Inverness
1901 Blundell, Rev. Odo, The Procurator, The Abbey, Fort-Augustus
1901 Brown, Charles M., Manager, Caledonian Bank, Inverness
1901 Burns, William, National Bank Buildings, Inverness
1901 Cameron, Gregor, Thorndhu, Nethy Bridge
1901 Cargill, A , Raigmore, Inverness
1901 Chisholm, William, Groam, Beauly
1901 Cruickshank, Peter Flett, Lovat Estates Office, Beauly
1901 Davidson, T. K., Kerrowaird, Gollanfield Station
1902 Douglas, Frances B., Balliemore, Nethy Bridge
1902 Elliot, William Robert, Drummond Street, Inverness
1902 Elliot, Matthew, jun., Drummond Street, Inverness
1901 Fraser, John Huntly, Dalneigh Farm, Inverness
1902 Fraser, Robert S., Bunchrew, Inverness
1901 Gillanders, Kenneth Alex., Queen's Gate, Inverness
1901 Golightly, George, Baron Taylor Lane, Inverness
1901 Gordon, Roderick, Wester Inshes, Inverness
1901 Grant, John C., Garvault, Advie, Strathspey
1901 Grant, Lewis, Culfoichbeg, Advie, Strathspey
1902 Grant, John, Mullochard, Strathspey
1901 Howie, Alex., Parks of Inshes, Inverness
1901 Junor, Donald, Robin Cottage, Drummond, Inverness
1901 Keay, Dr John, Lunatic Asylum, Inverness
1901 Ker, Andrew, Galacartray, Gollanfield, Croy
1901 Lawson, Dr L. S., Tigh-Tioral, Crown Drive, Inverness
1901 MacAllister, T. S., Imperial Hotel, Inverness

1901 M'Coll, A., 16 Eastgate, Inverness
1901 Macdonald, John, Duntulm, Isle of Skye
1901 Macdonald, Simon, Culduthel, Inverness
1901 Mackenzie, Captain A. F., of Ord, Beauly
1902 Mackenzie, Alex., Dochfour Estates Office, Queen's House, Academy St., Inverness
1901 M'Kenzie, David Fraser, Stratton, Culloden, Inverness
1902 Mackenzie, R. D., Inchrory, Beauly
1901 Mackenzie, Simon, The Hotel, Lochboisdale
1901 Mackintosh, Lachlan, Balvonie, Daviot, Inverness
1901 Mackintosh, W. W., of Raigmore, Inverness
1901 M'Lean, James, Merchant, Beauly
1901 Maclean, Neil, Nunton, Benbecula, Lochboisdale
1901 M'Lennan, John, Caledonian Stables, Inverness
1901 M'Leod, Murdo, Woodend, Drummond, Inverness
1901 Macpherson, John, Union Hotel, Inverness
1901 MacRae, Duncan A., Barnyards, Beauly
1901 Macrae, Roderick, jun., Lovat Arms Posting Establishment, Beauly
1901 M'Tavish, P. D., 36 Academy Street, Inverness
1901 Mann, John, Blackpark, Culloden, Inverness
1901 Mann, James, Easterfield of Inshes, Inverness
1901 Munro, Anderson, Ashton, Inverness
1901 Munro, Chas., Upper Muckovie, Inverness
1901 Munro, Duncan, Wester Galacartray, Gollanfield
1902 Murray, John, Rangemore Road, Inverness
1901 Nairn, Jas., Newton of Petty, Inverness
1902 Robertson, Donald, Breackachy, Newtonmore, Kingussie
1901 Robertson, Theodore, Auction Mart, Inverness
1902 Rose, David, Clunes, Dores, Inverness
1901 Shaw, D., Flichity, Inverness
1901 Shaw, John A., Slackbuie, Inverness
1901 Shields, William, British Linen Co Bank, Inverness
1902 Souter, James Francis, Commercial Bank, Inverness
1901 Steele, A. F., Bank of Scotland, Inverness
1902 Stephen, John W., Dell Cottage, Nethy Bridge
1901 Stewart, Charles D., of Brin, Inverness
1902 Stuart, Henry, Estate Office, Knoydart, Mallaig
1901 Thomson, Robt., of Kinmylies, Inverness
1902 Walker, James, Sawmills, Inverness
1902 Wolfenden, William, Wolfenden's Hotel, Kingussie
1901 Young, John, Oldtown, Inverness

NAIRN.

1901 Allan, James, jun., Penick, Nairn
1901 Allan, James A., Broomhill, Nairn
1901 Cameron, John, Merryton, Nairn
1902 Davidson, Donald, Newhall, Nairn
1901 Edgar, John Ingram, M.R.C.V.S., Nairn
1901 M'Callum, Peter, Drnim, Nairn
1901 Mackintosh, A. R., Leapark, Nairn
1901 MacLennan, Frederick, Fornighty, Nairn
1901 Macpherson, John, Tomich, Nairn
1901 Robertson, Alex., Cawdor Estate Office, Nairn
1901 Robertson, Hugh, Newton of Cawdor, Nairn
1901 Rose, Donald, Crook, Nairn

ORKNEY AND SHETLAND

1902 Horne, H. H., Trumland Farm, Rousay, Orkney
1901 Ironside, William A., Bankhead, Sandwick, Orkney

ROSS AND CROMARTY.

1901 Adam, William A., Humberston, Dingwall
1902 Bisset, John A., Drumderfit, Munlochy
1901 Brooke, John A., of Fearn Lodge, Ardgay
1901 Campbell, Alex., Balnabeen, Conon, Ross-shire
1901 Carnegie, Andrew, Skibo Castle, Ardgay
1902 Cowan, Alex., Balblair Distillery, Edderton
1901 Craigen, Alex., Kirkton, Invergordon
1901 Cran, David Reid, Ardmore Farm, Edderton
1901 Donald, David Johnstone, Salesman, Invergordon
1902 Dudgeon, Miss Ada, Woodlands, Dingwall
1901 Fearn, John, Tarradale Mains, Muir of Ord
1901 Fraser, James, Balville, Conon Bridge
1902 Garrow, William, Polmcol, Delny
1901 Jack, Alex., Easter Kinkell, Conon Bridge
1901 Laing, Robert P. S., Kinkell Castle, Conon
1901 M'Corquodale, A., Meddat, Parkhill, Ross-shire
1902 M'Donald, Andrew Hall, of Calrossie, Nigg, Ross-shire
1901 Macdonald, Gordon J., New More Mains, Invergordon
1901 M'Intyre, Alex. M., Findon Mains, Conon Bridge
1901 M'Kenzie, Donald, Meikle Ussie, Conon Bridge
1901 M'Queen, A. T., of Culmore, Black Isle
1901 M'Rae, Duncan J., Fairburn Mains, Muir of Ord
1901 Meldrum, Thos. G., Kilmuir Easter, Delny Station
1901 Menzies, James, Conon, Conon Bridge
1901 Munro, David, Tensgairn, Conon Bridge
1901 Munro, Finlay, of Rockfield, Fearn
1901 Munro, Kenneth, Tullich, Munlochy
1901 Peterkin, William, Dunglass, Conon Bridge
1901 Rattray, John, Phineas, Beauly
1901 Rattray, John C., Easter Moniack, Beauly
1901 Robertson, John, Implement Maker, Conon Bridge
1901 Robertson, John G., National Hotel, Dingwall
1902 Ross, Andrew George, Meikle Tarrel, Fearn
1901 Ross, William, Bridgend, Dingwall
1901 Sinclair, Donald, Dochcarty, Dingwall
1901 Sinclair, Donald, Balnaguie, Munlochy
1901 Taylor, John, Moultavie, Alness
1901 Thomson, C. G., Killen Farm, Avoch
1901 Watson, Arch., Corn Factor, Invergordon
1901 Wood, James, Hilton, Fearn, Ross-shire
1901 Young, George, Cadboll, Fearn, Ross-shire
1901 Young, James G., Cadboll, Fearn, Ross-shire

SUTHERLAND.

1901 Dudgeon, William John, Crakaig, Loth
1902 Macfarlan, Alex., Torish, Helmsdale

8.—BORDER DISTRICT.

BERWICK.

1901 Aitken, Captain John Christie, Nisbet, Duns
1901 Craw, James Hewat, West Foulden, Berwick-on-Tweed
1901 M'Dougall, Arthur Robert, Blythe, Lauder
1901 Paterson, D. T., Sinclair's Hill, Duns

ROXBURGH.

1902 Aitchison, John Wilson, Brieryhill, Hawick
1901 Russell, George Alex., Glen Douglas, Jedburgh
1901 Scott, John Alex., Mossburnford, Jedburgh

SELKIRK.

1901 Lindsay, William, Shaw Mount, Selkirk

ENGLAND.

1901 Bainbridge, Thos. H., Eshott Hall, Felton, Northumberland
1901 Dawson, Robert Alex., St Mary's, Talacre, Holywell, N. Wales
1902 Hobbs, James T., Maisey Hampton, Fairford, Gloucestershire
1901 Lindow, Mark Burns, Ingwell, Moor Row, Cumberland
1901 Morgan, George H., 73 Warwick Gardens, Kensington, London

COLONIES.

1902 Hodson, F. W., Live Stock Commissioner, Department of Agriculture, Ottawa, Canada

HOLDER OF FIRST-CLASS CERTIFICATE IN FORESTRY, FREE LIFE MEMBER.

1901 Rabagliati, Duncan S., 1 St Paul's Road, Bradford

Number of Members in List published in February 1901	6168
Number of Members admitted in June 1901	224
Number of Members admitted in January 1902	65
Certificate Holder admitted in June 1901	1
	6458
Deduct estimated deaths, &c.	138
Total	6320

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For List of Agents in Aberdeen, see 'Aberdeen Directory,' p. 619.